Extended Questions based on old exam papers

(Including 2016 papers)

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FOR AVAILING THE QUESTIONS FROM OLD EXAMPAPERS.

The Rössing Foundation

Note for the user: the question are selected from past examination papers and divided in 30 sections.
Answers to these questions are also available on the website.

Questions are answered by T Hanemaaijer any remarks or errors please send to thanem123@gmail.com

Content:

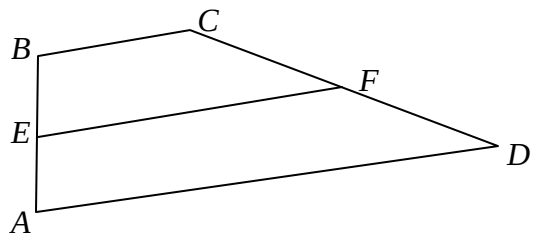
Sample of possible Exam questions arranged per topic Extended level

Section 1 Vectors [Marks are indicated in [ ] brackets]

1 [P2 Oct/Nov 2007 Q 9]

(a) Given that $\overrightarrow{PQ} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$, $\overrightarrow{QR} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ and $\overrightarrow{RS} = \begin{pmatrix} 1 \\ -5 \end{pmatrix}$, find $\overrightarrow{PS}$. [1]

(b)



In the diagram, $\overrightarrow{AB} = 2\vec{b}$, $\overrightarrow{AD} = 3\vec{a}$ and $\overrightarrow{DF} = \vec{b} - \vec{a}$.

E is the midpoint of *AB* and *F* is the midpoint of *DC*.

(i) Express as simple as possible, in terms of $\vec{a}$ and/or $\vec{b}$.

(a) $\overrightarrow{EA}$ **(b)** $\overrightarrow{DC}$ **(c)** $\overrightarrow{EF}$ **(d)** $\overrightarrow{BC}$ each: [1]

(ii) (a) Give the special name for quadrilateral *ABCD*, give reasons [2]

(b) Find the ratio $\left|\overrightarrow{BC}\right| : \left|\overrightarrow{EF}\right| : \left|\overrightarrow{AD}\right|$ [1]

2 [P1 May/June 2003 Q 10]

Given $\vec{a} = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$, $\vec{b} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$, $\vec{c} = \begin{pmatrix} u \\ 10 \end{pmatrix}$

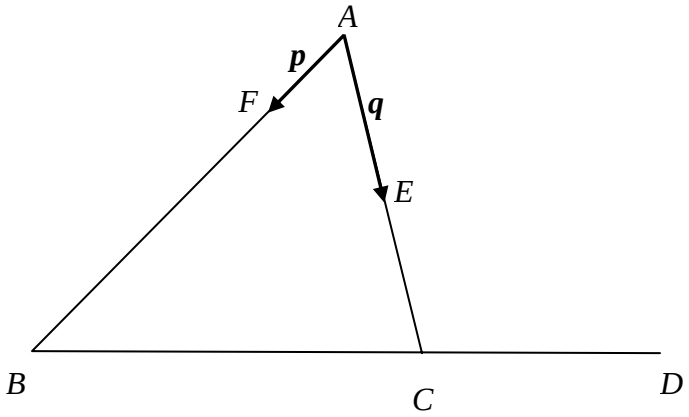
(a) Express $2\vec{a} + \vec{b}$ as a column vector. [1]

(b) Given that the vector $\vec{c}$ is parallel to vector $\vec{a}$, calculate the value of *u*. [1]

3 [P1 Oct Nov 2011 Q28]

In the diagram *F* is the point on *AB* where AF = $\frac{1}{4}AB$.

E is the midpoint of *AC*. $\overrightarrow{AF}$ = **p** and $\overrightarrow{AE}$ = **q.**



(a) Express in terms of **p** and **q**,

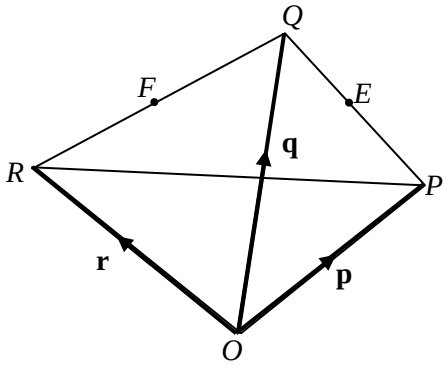
(i) $\overrightarrow{FE}$ and **(ii)** $\overrightarrow{BC}$ both: [1]

(b) *D* is the point on *BC* produced such that **BD** = *k* **BC**

(i) Express $\overrightarrow{FD}$ in terms of *k*, **p** and **q.** [1]

(ii) Given that *F*,*E* and *D* are collinear, find the value of *k*. [2]

4 [P1 May/June 2003 Q 23]



In the diagram, $\overrightarrow{OP}$ = **p,** $\overrightarrow{OQ}$ = **q,** $\overrightarrow{OR}$ = **r.**

The midpoints of *PQ* and *QR* are *E* and *F* respectively.

(a) Express as simply as possible in terms of **p** and/of **q,**

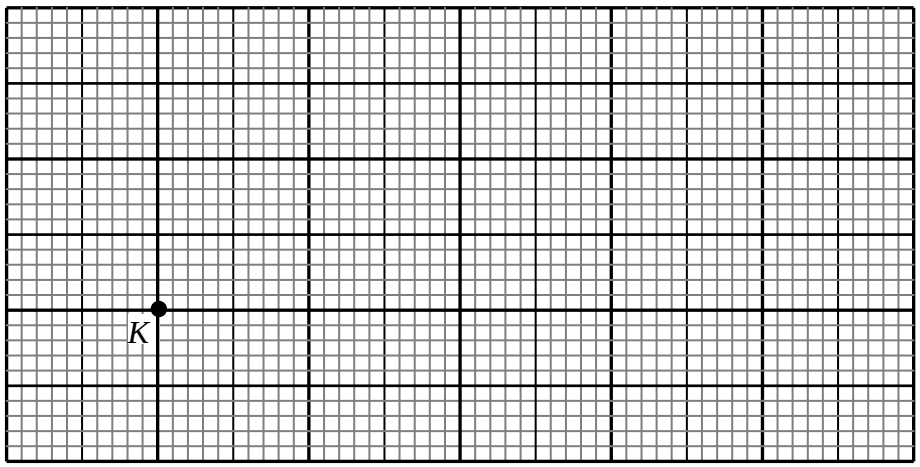
(i) $\overrightarrow{PE}$ **(ii)** $\overrightarrow{OE}$ each [1]

(b) Hence write down $\overrightarrow{OF}$ [1]

(c) Find $\overrightarrow{EF}$ [1]

(d) Write down two facts of EF and PR. [1]

5 **[**P2 NSSC 2008 Q 16]



(a) Using a scale of 1 cm to represent 1 unit draw the vectors:

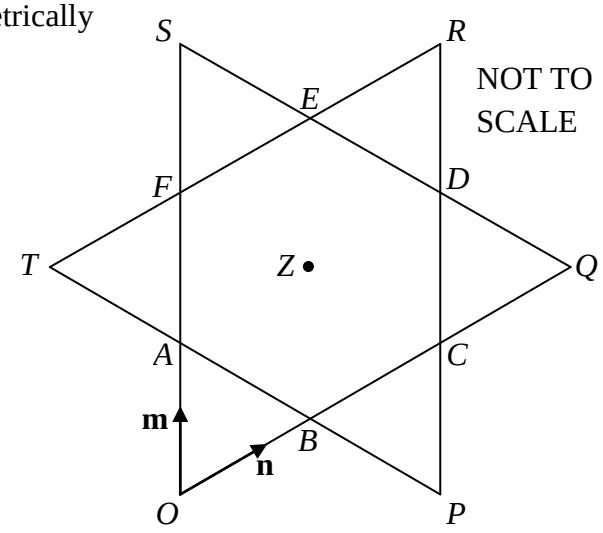
$\overrightarrow{KL} = \begin{pmatrix} 5 \\ 0 \end{pmatrix}$ $\overrightarrow{LM} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ on the grid [2]

(b) Find vectors $\overrightarrow{KN}$ and $\overrightarrow{MN}$

In column notation Such that *KLMN* is a kite. [2]

6 [P4 NSSC 2011 Q 6]

Two equilateral triangles, *OQS* and *RTP* are arranged symmetrically over each other as shown to the right. The point, *Z*, is the centre of the two triangles. $\overrightarrow{OA}$ = **m,** and $\overrightarrow{OB}$ = **n.**



(a) Name the shape *ABCDEF*. [1]

(b) (i) Describe the rotational symmetry of this geometric shape. [1]

(ii) How many lines of symmetry does the shape have? [1]

(c) Describe fully the single transformation which maps

(i) triangle *TPR* onto triangle *TAF* [3]

(ii) triangle *OBA* onto triangle *RDE*, with *O* mapped onto *R* and *B* mapped onto *D*. [2]

(d) Write the following vectors in terms of **m** and/or **n**, giving Your answer in the simplest form.

(i) $\overrightarrow{OS}$ **(ii)** $\overrightarrow{BA}$ **(iii)** $\overrightarrow{CD}$ each [1]

(iv) $\overrightarrow{OD}$ **(v)** $\overrightarrow{FC}$ each [2]

(e) When $|\mathbf{m}| = 5$, write down the value of **(i)** $|\mathbf{n}|$ **(ii)** $|\mathbf{m} - \mathbf{n}|$ each [1]

7 **[**P4 NSSC 2007 Q 6]

$\overrightarrow{AB} = \begin{pmatrix} -8 \\ 3 \end{pmatrix}$ and $\overrightarrow{BC} = \begin{pmatrix} 4 \\ 0 \end{pmatrix}$

(a) Express $\overrightarrow{AC}$ as a column vector. [1]

(b) *D* is the point (–2, –1) and *E* is the point (2, *h*)

(i) Express $\overrightarrow{DE}$ as a column vector. [2]

(ii) If *DE* is parallel to *AB* find the value of *h*. [3]

(iii) If instead $\left|\overrightarrow{DE}\right| = \left|\overrightarrow{AC}\right|$, find the two possible values for *h*. [4]

8 [P4 NSSC 2009 Q 7]

$\overrightarrow{OA} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$, $\overrightarrow{OB} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$ and $\overrightarrow{OC} = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$

(a) (i) Show that $\overrightarrow{BA} = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$ [2]

(ii) Express AC as a column vector. [2]

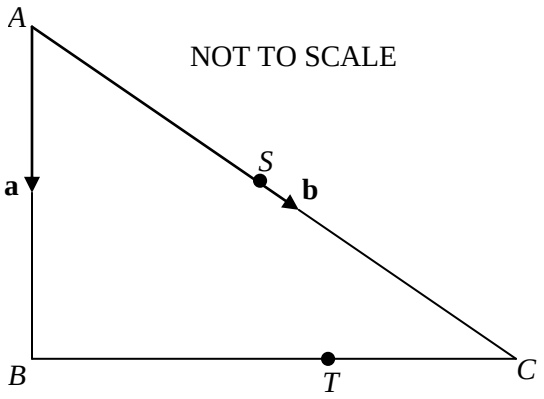
(b) Calculate $\left|\overrightarrow{OA}\right|$ [3]

(c) If $\overrightarrow{AD} = 2\overrightarrow{AB}$, find $\overrightarrow{AD}$ [4]

9 [P4 2013 Q7]

In triangle ABC, the point S divides the line AC in half. The point T divides the line BC in the ratio 3 : 2.

$\overrightarrow{AB}$ = **a** and $\overrightarrow{AC}$ = **b**.



(a) Express the following in terms of **a** and **b**.

(i) $\overrightarrow{AS}$, [1]

(ii) $\overrightarrow{BS}$, [2]

(iii) $\overrightarrow{BT}$. [1]

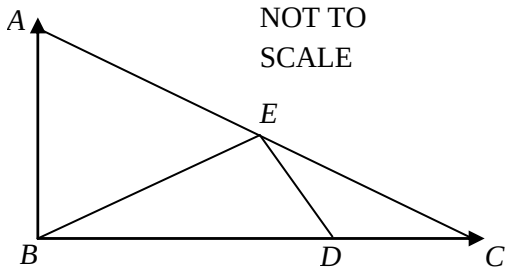
(b) Show that $\overrightarrow{ST}$ is $\frac{1}{10}(4\mathbf{a} + \mathbf{b})$. [3]

(c) It is given that $\mathbf{p} = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$, $\mathbf{q} = \begin{pmatrix} -2 \\ -2 \end{pmatrix}$ and $\mathbf{r} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$.

(i) Calculate the vector represented by $3\mathbf{p} - \mathbf{q} + 2\mathbf{r}$ [2]

(ii) Calculate the magnitude of $\mathbf{p} + \mathbf{q}$ [3]

10 [P4 NSSC 2014 Q 7]



(a) The diagram shows triangle ABC. The point D lies on the line BC and divides BC in the ratio 2 : 1. The point E is the midpoint of line AC. It is given that $\overrightarrow{BA}$ = **a** and $\overrightarrow{BC}$ = **b**.

Express the following vectors in terms of **a** and **b** in its simplest form.

(i) $\overrightarrow{AC}$ [1]

(ii) $\overrightarrow{BE}$ [2]

(iii) $\overrightarrow{DE}$ [2]

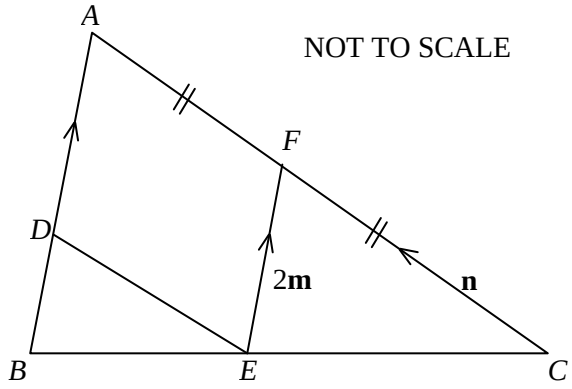
(b) It is given that $\mathbf{p} = \begin{pmatrix} 3 \\ -5 \end{pmatrix}$, $\mathbf{q} = \begin{pmatrix} 4 \\ 4 \end{pmatrix}$ and $\mathbf{r} = \begin{pmatrix} -2 \\ -2 \end{pmatrix}$

(i) Find vector $2\mathbf{p} - \mathbf{q}$ [2]

(ii) Calculate the magnitude of $\mathbf{p} + \mathbf{q} - 2\mathbf{r}$. [3]

(iii) What is the relationship between **q** and **r**? [2]

11 [P4 NSSC 2015 Q 6] **[This question has an error for more details see the answers]**



In the diagram, *BD* : *DA* = 1 : 2 and *CF* = *FA*. $\overrightarrow{CF}$ = **n**

$\overrightarrow{EF}$ = 2**m** and $\overrightarrow{BA}$ =3**m**

(a) (i) Write $\overrightarrow{EC}$ in terms of **m** and **n** [1]

(ii) Write $\overrightarrow{DE}$ in terms of **m** and/or **n** [1]

(iii) Write $\overrightarrow{BD}$ in terms of **m** . [2]

(b) Explain why line *DE* is parallel to *AC*. [1]

(c) Given that **a** = $\begin{pmatrix}-1\\0\end{pmatrix}$, **b** = $\begin{pmatrix}2\\-4\end{pmatrix}$, **c** = $\begin{pmatrix}7\\4\end{pmatrix}$ and **d** = $\begin{pmatrix}18\\0\end{pmatrix}$

Find **(i)** 2**b** – **c** **(ii)** |**a** + **b**| [2] [3]

(d) Use the vectors given in part **(c)** to answer this question. It is given x**b** + y**c** = **d.**

(i) Write down two simultaneous equations in terms of x and y. [2]

(ii) Solve these equations to find the values of x and y. [3]

Section 2 Functions & long division of a polynomial by a binomial.

1 [P1 May/June 2003 Q17]

A function is defined by f(x) = 3x + 4.

(a) Given that f(k) = k, find k. [2]

(b) Find the inverse of f. [2]

2 [P1 May June 2006 Q 14]

(a) f(x) = (x + 2)(2x – 1). Evaluate f(5.5) [1]

(b) g(x) = $\frac{1}{3}$(2x – 1). Find $g^{-1}(5)$. [2]

3 [P1 Oct/Nov 2011 Q 14]

It is given that f(x) = $\frac{3+x}{2}$

(a) Find f(–3) **(b)** Find $f^{-1}(x)$ each [1]

4 [P4 NSSC 2008 Q 10]

Given f(x) = $\frac{4}{x+1}$ and g(x) = $x^2 - 3$

(a) Explain why f(x) is undefined for x = –1. [1]

(b) Find f(3) [1]

(c) Determine fg(x) in its simplest form. [2]

(d) Determine $f^{-1}(x)$. [3]

(e) Show that f(x) = g(x) simplifies to $x^3 + x^2 - 3x - 7 = 0$ [2]

(f) Find the quotient and the remainder when $x^3 + x^2 - 3x - 7$ is divided by (x – 2) [4]

5 [P4 NSSC 2011 Q 10]

(a) Given that f(x) = $\frac{x+a}{x-4}$ (for $x \neq 4$) and that f(10) = 2, find

(i) the value of a [2]

(ii) $f^{-1}(-4)$ [3]

(b) If g(x) = x + 2, find fg(x) [2]

6 [P2 NSSC 2009 Q 19]

Divide $x^3 - x^2 + x - 21$ by $x - 3$. [3]

7 [P4 NSSC 2013 Q 8(c)]

(c) Find the quotient and remainder when $2x^3 + 5x^2 - 8x - 15$ is divided by $x + 4$ [4]

8 [P2 NSSC 2014 Q 10]

Functions f, g and h are such that f(x) = $(x - 1)^2$ g(x) = $(x - 1)^3$ h(x) = $2x + 1$.

(a) Work out fg(−1) [2]

(b) Find gh(x) in its simplest form. [2]

(c) Find $h^{-1}(x)$. [2]

9 [P4 NSSC 2014 Q 11(b)]

Find the quotient and remainder when $4x^3 + 6x^2 - 3x + 16$ is divided by $x - 3$. [4]

10 [P2 NSSC 2015 Q 11]

It is given that f(x) = $2x^2 + 1$ and g(x) = $4 - 3x$

Find

(a) f(2) [1]

(b) x, when g(x) = 0 [2]

(c) $g^{-1}(x)$ [2]

(d) fg(x) [4]

(e) Solve f(x) = g(x), giving your answer correct to 2 decimal places. [5]

11 [P2 NSSC 2015 Q 15]

An algebraic expression $x^3 + 3x^2 - 5$ can also be written as $(x - 2)(ax^2 + bx + c) + R$.

Find the values of a, b, c and R. [4]

Section 3 Linear Programming

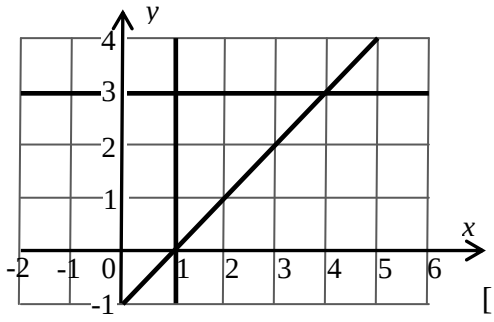
1 [P1 May/June 2006 Q 10 (b)]

The diagram shows the graphs of $x = 1$, $y = 3$ and $y = x - 1$

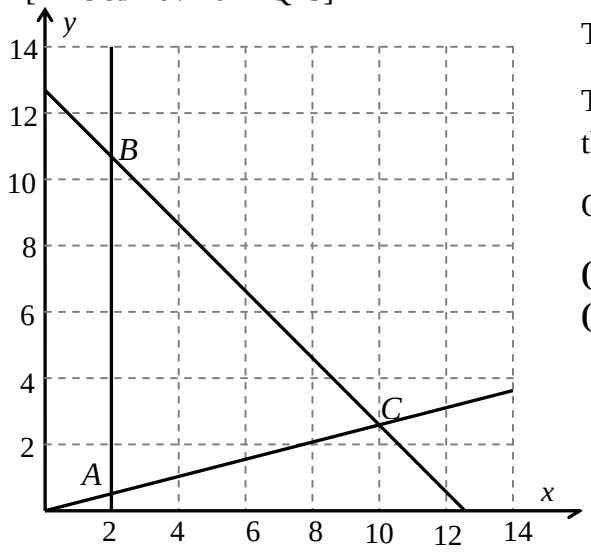
The region, **R** , is defined by the inequalities

$x > 1$, $y < 3$ and $y > x - 1$.

Given that the point (x, y) is in the region **R**, find the integer values x and y. [1]



2 [P1 Oct/Nov 2011 Q25]



The diagram shows the graphs of $x + y = 12\frac{1}{2}$, $y = \frac{x}{4}$ and $x = 2$.

These graphs intersect to form triangle *ABC*. The region **inside** the triangle is defined by three inequalities.

One of these is $y > \frac{x}{4}$

(a) Write down the other two inequalities. [2]

(b) **(i)** Find the point closest to C with integers as coordinates. [1]

(ii) Find all the points with integers as coordinate, inside triangle *ABC* with *x* coordinate 7. [1]

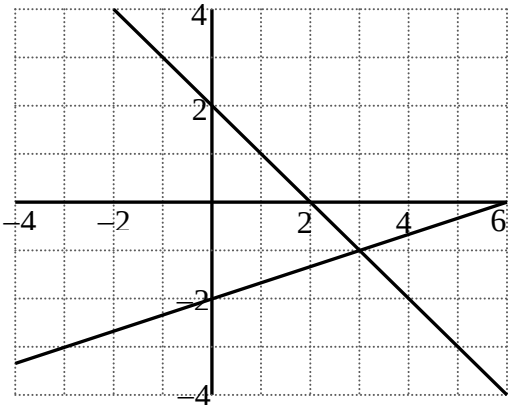
3 [P1 May June 2003 Q 15]

The lines $x + y = 2$ and $x - 3y = 6$ are shown in the diagram

(a) Find the gradient of the line $x - 3y = 6$. [1]

(b) On the diagram shade the region defined by

$x + y \leq 2$, $x - 3y \leq 6$ and $x + 1 \geq 0$ [2]



4 [P4 NSSC 2008 Q 5]

A company decided to build *x* low-cost houses and *y* high-cost houses for its employees on a 56 000 m^2 piece of land. Each low-cost house takes up 400 m^2 of land and each high-cost land takes up 700 m^2.

(a) Show that this information leads to the inequality: $4x + 7y \leq 560$. [1]

(b) The number of high-cost houses must not be more than the low-cost houses. Write an inequality to show this information. [2]

(c) There must be at least 10 high-cost houses. Write down an inequality to represent this information. [1]

(d) Using a scale of 1 cm to represent 10 units on both axes, draw an *x*-axis for $0 \leq x \leq 150$ and a *y*- axis for $0 \leq y \leq 90$. Draw the three inequalities in parts **(a); (b)** and **(c).** Shade the unwanted regions. [6]

(e) When 40 low-cost houses are built, what is the largest possible number of high-cost houses? [1]

(f) The estimated building cost of a low-cost house is N$200 000 and for a high-cost house is N$ 500 000. Find the largest possible amount the company would spent on this project. [2]

5 [P4 NSSC 2009 Q 2]

A farmer keeps *x* sheep and *y* cows. Each sheep cost N$10 a day to feed and each cow costs N$20 a day to feed. The farmer can only afford to spend N$160 per day on animal feed.

(a) Show that $x + 2y \leq 16$ [2]

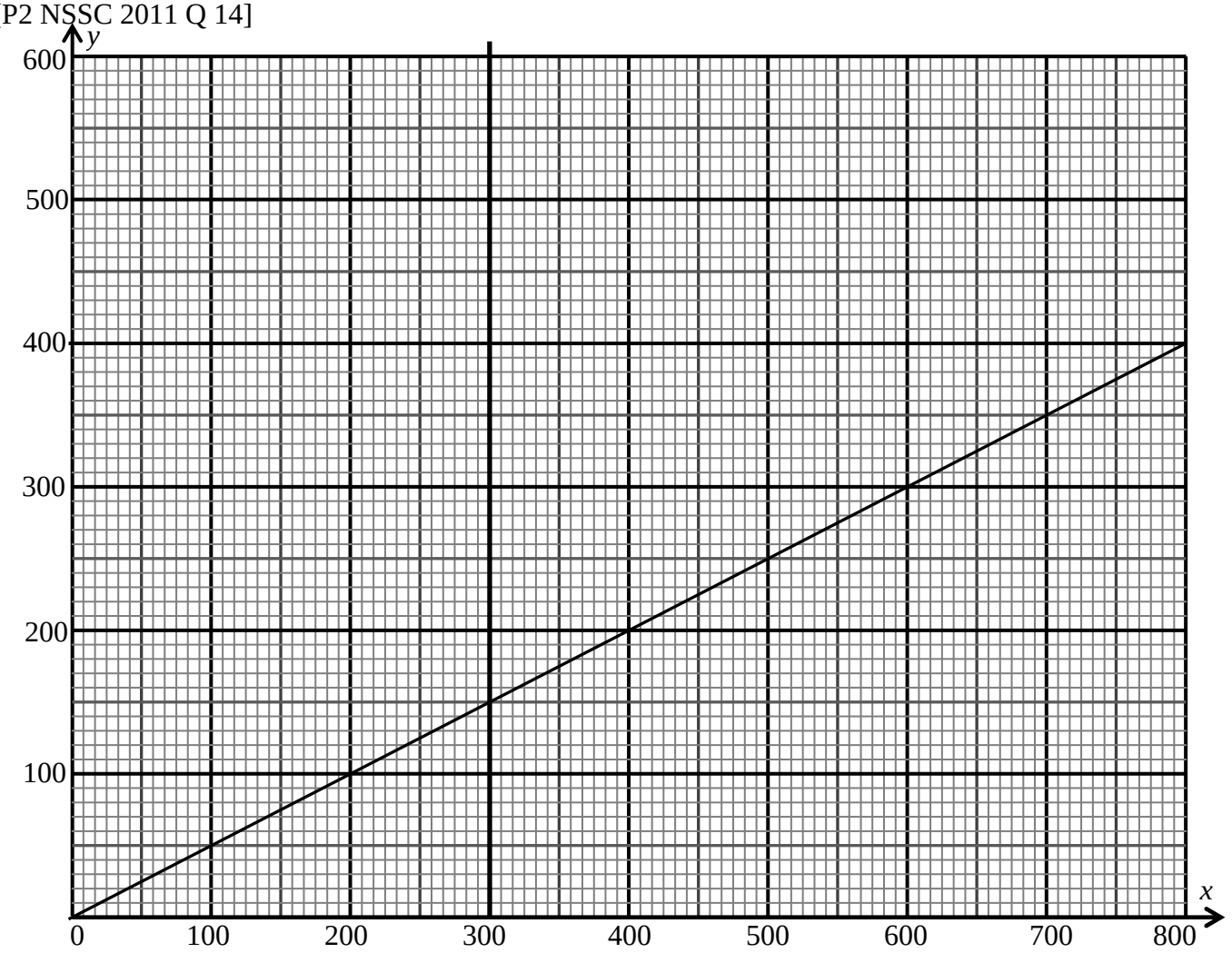
(b) The farmer cannot keep more than 12 animals on his fields. He wants to keep at least 6 sheep and at least 3 cows. Write down three more inequalities. [3]

(c) Using a scale of 1 cm to represent one unit on each axis, draw these four inequalities on a graph. [4]

(d) Use your graph to write down all the possible combinations that will satisfy all inequalities. [3]

(e) The farmer makes a profit of N$150 on each sheep and N$300 on each cow that he sells. Calculate the maximum profit he can make. [2]

6[P2 NSSC 2011 Q 14]



On the given grid **(a)** Draw the lines $y = 400$ and $x + y = 500$ [2]

(c) Shade the **unwanted** region for the following inequalities

① $x \leq 300$ ② $y \geq \frac{1}{2} x$ ③ $y \leq 400$ ④ $x + y \leq 500$

Label, **R**, the region that will satisfy all the inequalities. [2]

7 [P4 NSSC 2014 Q 9] **Use a graph paper to answer this question.**

A dog breeder has x Dobermans and y Bulldogs. The breeder has 7 or fewer Dobermans and no more than 8 Bull dogs. She has enough room in her kennels for not more than 10 dogs in total at a time.

(a) Express the three conditions as inequalities. [3]

(b) Using 1 cm = 2 dogs on the x-axis and 2 cm = 1 dog on the y-axis draw the three inequalities on the axes. [5]

(c) Shade the regions which do not satisfy the inequalities, leaving the region which satisfies the inequalities unshaded. [1]

(d) State the maximum number of Dobermans and Bulldogs the breeder can have at any given time. [2]

(e) The breeder sells the Bulldogs for N$2500 per dog and the Dobermans or N$3500 per dog.

(f) Calculate the maximum profit the breeder can make. [3]

Section 4 Commercial arithmetic Reverse percentages & percentage increase

1 [P1 May June 2006 Q 7]

A dealer sold a painting for $800. She made a profit of 25% on the price she paid for it.

Calculate the price she paid for the painting. [2]

2 [P1 Oct/Nov 2011 Q 12]

The length of a rectangle is 8 cm. It is increased by 150%. Calculate the new length. [2]

3 [P1 May/June 2006 Q 3]

The rate of exchange between pounds (£) and dollars ($) was £1 = $2.80.

Calculate: **(a)** the number of dollars received in exchange for £120. [1]

(b) the number of pounds received in exchange for $224. [1]

4 [P2 Oct/Nov 2007 Q 4]

(a) In 2005, the cost of posting a letter was 28 cents. A company posted 1200 letters and was given 4% discount on the cost. Calculate the total discount. [1]

(b) In 2006, the cost of posting a letter was increased from 28 cents to 35 cents. Calculate the percentage increase in the cost of posting a letter. [2]

(c) After the price increase to 35 cents, the cost to the company of posting 1200 letters was $399. Calculate the percentage discount that the company was given in 2006. [2]

(d) In 2006, it cost $4.60 to post a parcel. This was an increase of 15% on the cost in 2005. Calculate the cost of posting this parcel in 2005. [3]

5 [P1 May/June 2003 Q 12]

Five items are bought in a shop.

The receipt is shown:

Apples	
Roll	1.35
Mineral water	1.20
Cheese	1.64
Tomatoes	1.20
Total	$ 5.90

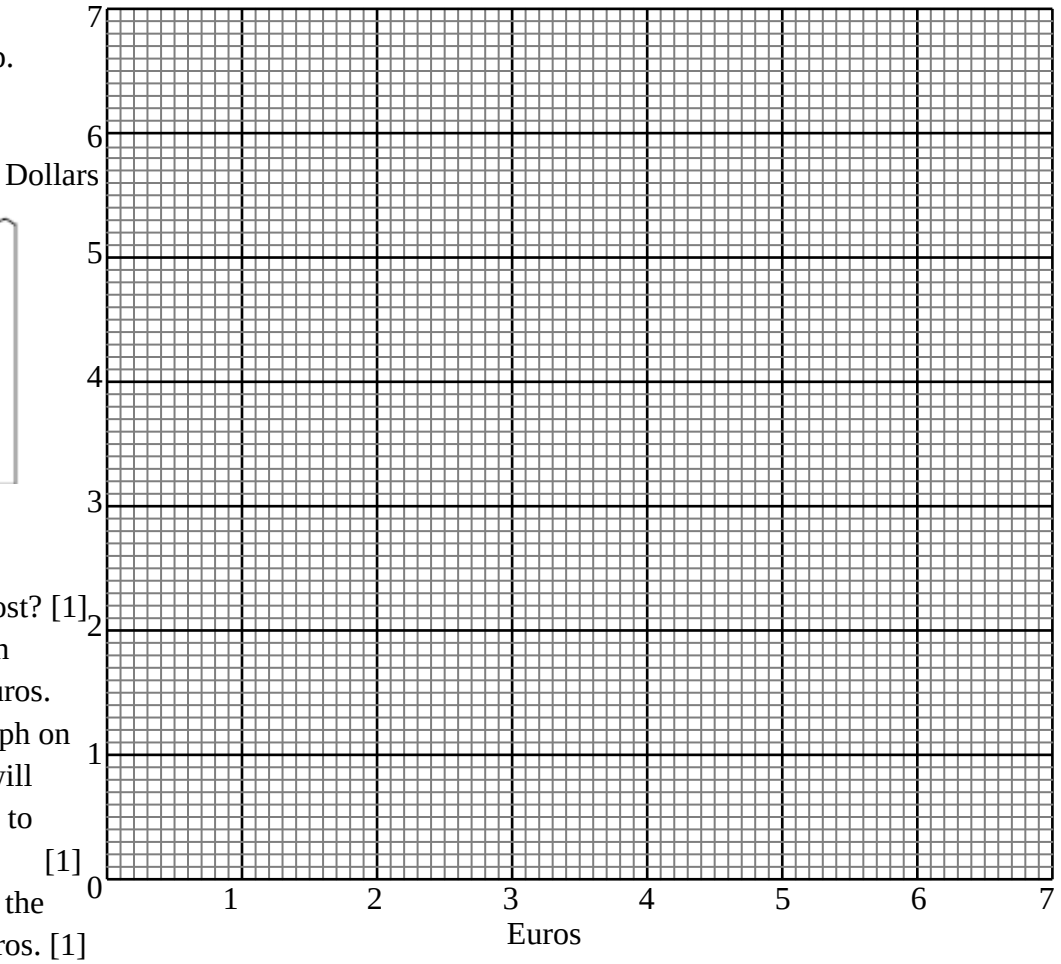
The part showing the cost of the apples is missing.

(a) How much did the apples cost? [1]

(b) The total cost of $5.90 when converted to euros is 6.80 euros.

(i) Using these totals, draw graph on the axes to the right which will enable you to convert dollars to euros. [1]

(ii) use your graph to estimate the cost of mineral water in euros. [1]



6 [P2 May June 2005 Q 2 (b)]

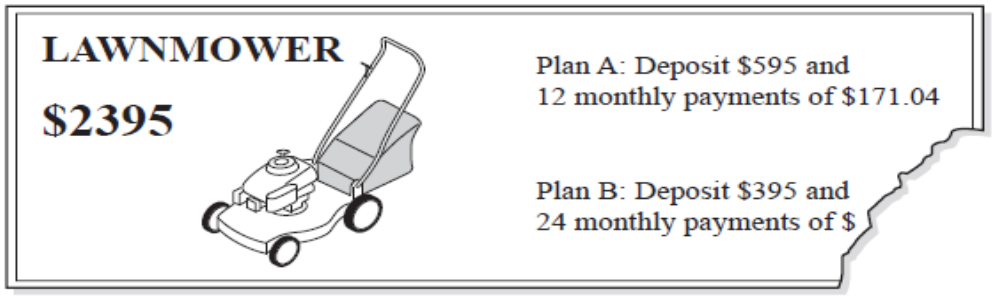
During a sale a shop sold packets of tea for 20% less than the price shown on their labels.

Elizabeth and Peter each bought a packet of tea in the sale.

(a) Elizabeth's packet had a label price of $4.50, how much did she pay? [1]

(b) Peter paid $6.20 for his packet. Calculate the price shown on the label. [2]

7 [P2 Oct/Nov 2011 Q 6(b)]



(a) Rashid buys one of these lawnmowers for $2395. Sayeed buys one of these lawnmowers using plan A. In total how much **more** than Rashid will Sayeed pay? [1]

(b) When one of these lawnmowers is bought using plan B, the total cost is $3054.20. Calculate the monthly payment. [2]

(c) In a sale, the price of the lawnmower is reduced from $2395 to $1595. Calculate the percentage discount. [2]

8 [P2 Oct/Nov 2007 Q 2 (b)]

A shopkeeper sells pens and pencils. Each pen costs $5 and each pencil cost $3.
One day he sold x pens. On the same day he sold 9 more pens than pencils.

(a) Write down an expression, in terms of x, for his total income from the sale of these pens and pencils. [2]

(b) This total income was less than $300. Form an inequality in x and solve it. [2]

(c) Hence write down the maximum number of pens that he sold. [1]

9 [P2 NSSC 2011 Q 21]

A father has a daughter who has just had her 17th birthday. He plans to give her N$50 000 on her 21st birthday. How much money must he invest now, if the interest rate is 15% p a compound interest? [3]

10 [P4 NSSC 2013 Q 1]

Donny won N$75 000 in a lottery. He divides his winnings in the ratio 3 : 2. He uses the smaller amount As a deposit on a car. He invests the rest in a bank at a simple interest of 5.5% per annum.

(a) Calculate the deposit he paid on the car. [2]

(b) The deposit he paid on the car was 15% of the value of the car. Show that the value of the car was N$200 000. [3]

(c) Donny must pay N$4 550 a month for 54 months for the car. Calculate the percentage increase in the price of the car. [2]

(d) Calculate the percentage increase in the price of the car. [2]

(e) Calculate the interest Donny will receive from the investment at the bank after 1.5 years. [2]

11 [P2 NSSC 2013 Q 6]

Namibia imports crude oil. The cost of crude oil is US$33. Calculate the cost of importing 2000 barrels of oil, in N$, on a day when the exchange rate is N$8.20 per US dollar. [2]

12[P2 NSSC 2014 Q 11]

In how many years will N$420 increase to N$1000 at 8% compound interest per annum if interest Is calculated annually? Give the answer correct to two decimal places. [4]

13 [P4 NSSC 2014 Q 2]

In a class of 45 learners there are 29 boys. The class takes a mathematics test at the end of each month. Each test is out of 30 marks.

(a) What percentage of the class is girls? [2]

(b) At the end of September only 31% of the learners in the class passed the test. How many learners passed the test at the end of September? [2]

(c) At the end of September, learners have to get 18 marks to pass the test. This was 6% more than the pass mark for the end of August. Calculate the pass mark for the end of August. [2]

(d) At the end of August, 24 learners passed the test. What was the percentage decrease in the pass rate between the months of August and September? [2]

14 [P2 NSSC 2015 Q 2]

In a promotional sale, prices of all goods in the JETOX shop are reduced by 10%. Johannes buys a jacket at a reduced price of N$450. Calculate the original price of the jacket. [2]

15 [P4 NSSC 2015 Q 2]

(a)

BANK A
Savings account
7% per year
SIMPLE INTEREST

BANK b
Savings account
9% per year
COMPOUND INTEREST

Lukas and his sister, Sosa, have N$2500 each to invest.

(i) Lukas invests his money in BANK A. How much will he have at the end of 3 years? [3]

(ii) Sosa invests her money in BANK B. How much will she have at the end of 3 years? Give your answer correct to 2 decimal places. [3]

(iii) Calculate the percentage increase in Lukas's money. [3]

(b) Johanna received N$3 600 from her bank. This is an increase of 20% on her original investment. Calculate the amount of her original investment. [3]

16 [P4 NSSC Q2 2016]

Andrea earned N$210 000 in 2013. Andrea's tax-free contributions per year are: N$10 500 to the pension fund and N$30 000 for a study policy.

(a) Calculate Andrea's taxable income. [1]

(b) Andrea must pay N$9 000 + 25% of x, where x is the amount exceeding N$100 000 of her taxable income. [3]

(c) She received a housing subsidy of N$32 000 per year. Show this as a percentage of her salary. [3]

(d) Andrea's salary is 5% more than her salary in 2012. Calculate Andrea's salary in 2012. [3]

(e) Andrea bought a car for N$150 000. The value of the car goes down by 15% per year. Calculate how much the car will be worth after 3 year. [3]

Section 5 Accuracy; rounding off; significant figures; standard form; estimation.

1 [P1 May June 2006 Q 4]

Complete the statements in the answer spaces. **(a)** 4872 correct to one significant figure is: [1]

(b) 4872 correct to ….. significant figures is 4870 [1]

2 [P1 May June 2006 Q 9 (a)]

The thickness of an oil film is 0.000 004 cm. Express in standard form. [1]

3 [P1 May June 2006 Q 16(b)]

The length and width of a rectangle are 50 cm and 15 cm respectively. Each measurement is correct to the nearest centimeter.

(a) Write down the upper bound of the length.

(b) Find the least possible perimeter of the rectangle.

4 [P1 Oct/ Nov 2011 Q 5]

(a) Express the number 0.000 042 in standard form. [1]

(b) Calculate $(7 \times 10^{-3}) \times (3 \times 10^{9})$, giving your answer in standard form. [1]

5 [P1 Oct/ Nov 2011 Q 11]

By writing each number correct to two significant figures, estimate, correct to one significant figure the value of $\sqrt{110.94 \times 0.2034 \times 368.62}$ [2]

6 [P1 Oct/ Nov 2011 Q 17]

The length of a side of a square is given as 57 mm, correct to the nearest millimeter.

(a) Write down the upper bound for the length of a side. [1]

(b) Giving your answer in **centimeters,** calculate the upper bound for the perimeter of the square. [2]

7 [P1 May June 2003 Q 8(b)]

The length of a piece of string is 0.026 metres, correct to the nearest millimeter.

Write down, in millimeters, the lower bound of this length. [1]

8 [P1 May June 2003 Q 9]

$p = 3.2 \times 10^{11}$ and $q = 8 \times 10^{-4}$. Express your answer in standard form, evaluate

(a) q^2 **(b)** $p \div q$

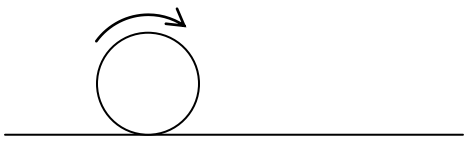
9 [P2 NSSC 2008 Q 7]

The circumference, C cm, of a wheel is 60 cm to the nearest 10 cm.

(a) Complete the inequality for C. …… $\leq C <$ …… [1]

(b) The wheel rolls in a straight line for a distance of 4.55 m.

Calculate the maximum and minimum number of **complete** revolutions it would make.



(i) Maximum number : …… [2]

(ii) Minimum number: …… [1]

10 [P2 NSSC 2013 Q 2]

(a) Change 62 square meters into square millimeters. [1]

(b) Write your answer to **(a)** in standard form. [1]

11 [P2 NSSC 2013 Q 5]

The length of a side of a regular pentagon is 6.5 cm, correct to one decimal place.

Find the least possible perimeter of the pentagon. [2]

12 [P2 NSSC 2014 Q 2]

A square has a side length of 25 mm, correct to the nearest millimeter.
Calculate the greatest possible area. [2]

13 [P2 NSSC 2014 Q 4]

Write 0.00759

(a) In standard form [1]

(b) Correct to 2 significant figures. [1]

14 [P4 NSSC 2014 Q 4]

A rectangular piece of cardboard has a length of 30 cm and a width of 21 cm. A circle with radius of 5 cm is cut out from the cardboard. All the measurements are to the nearest cm.
Find the maximum and minimum possible area that will be left of the cardboard.
Show all your working. [5]

15 [P2 NSSC 2015 Q1]

(a) Write each of the following numbers correct to 1 significant figure. 201 99 4.9 [2]

(b) Hence, estimate the value of $\frac{201 \times 99}{4.9}$ [1]

16 [P2 NSSC 2015 Q3]

(a) Work out $3(2 \times 10^6 - 4 \times 10^5)$, giving your answer in standard form. [2]

(b) Given that $2 \times 10^3 + 3 \times 10^2 + 4 \times 10^x + 6 \times 10^y = 2304.06$, where x and y are integers, find the value of x and y. [2]

17 [P2 NSSC 2015 Q6]

Albertina travelled from Oshakati to Windhoek. The distance between Oshakati and Windhoek is 800 km, to the nearest 100 km. The trip took her 12.8 hours, correct to 1 decimal place.
Calculate her maximum average speed. [4]

18 [P2 NSSC 2016 Q1]

Use your calculator to find the value of $3\times \sqrt{2\times 15} + \sqrt{900}$ Give your answer correct to 1 dec. pl. [2]

Section 6 Speed; speed time graph; distance time graph; duration and time difference

1 [P1 May June 2006 Q 5(a)]

A journey of 170 kilometres took $4\frac{1}{4}$ hours. Calculate the average speed in km/h. [1]

2 [P1 May June 2006 Q 8]

(a) The time difference between Brunei and London in 7 hours. So, when it is 19 00 in Brunei, it is 12 00 in London. When it is 03 30 in Brunei, what time is it in London? [1]

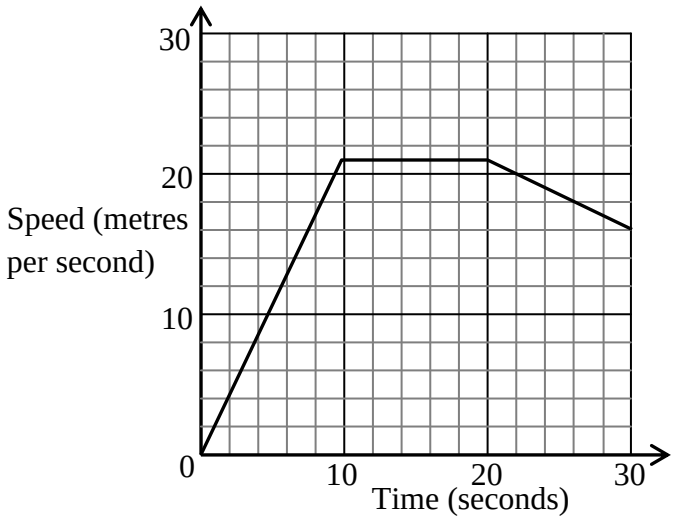
(b) An aircraft leaves Brunei at 6 30 p m local time. It arrives in Dubai at 10 p m local time. The flight took 7½ hours. Calculate the time difference between Dubai and Brunei. [1]

3 [P1 May June 2006 Q 15]

A cyclist took 30 seconds to ride from *A* to *B*.
The diagram is the speed-time graph of his ride.
Calculate

(a) the distance *A* to *B*. [2]

(b) his retardation during the final 10 seconds. [1]



4 [P1 Oct/ Nov 2011 Q 18]

Renata went on a journey that took 7½ hours.

(a) The journey started at 22 48 on Monday.
At what time on Tuesday did it finish? [1]

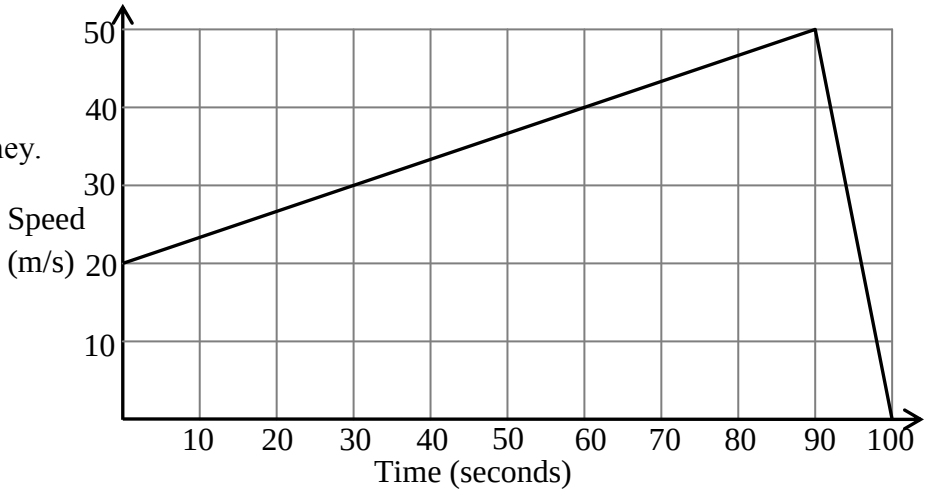
(b) In the first part of the journey Renata travelled 150 km in 5 hours. She travelled at an average speed of 20 km/h for the rest of the journey. Calculate the average speed of the whole journey. [2]

5 [P1 Oct/ Nov 2011 Q 21]

The diagram is the speed time graph of the last 100 seconds of a train's journey.

(a) Calculate the train's retardation during the last 10 seconds of the journey. [1]

(b) Calculate the distance travelled in the 100 seconds. [2]

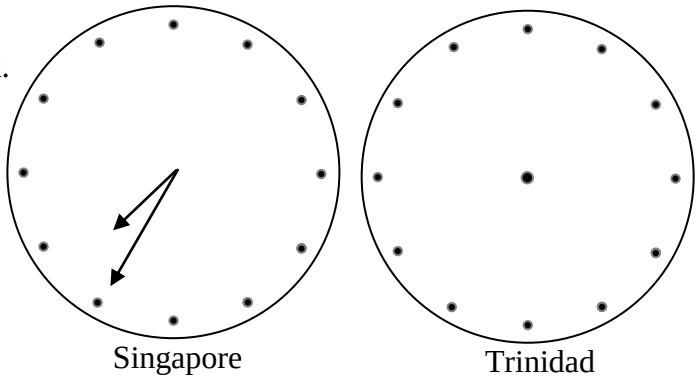


6 [P1 May/June 2003 Q 4]

Local time in Singapore is 11 hours ahead of Trinidad.

(a) Look at the two clocks in the answer space.
One shows the local time in Singapore.
Show the local time in Trinidad on the other clock.

(b) It is 9 15 am in Trinidad.
Using the 24 hour clock,
write down the local time in Singapore.



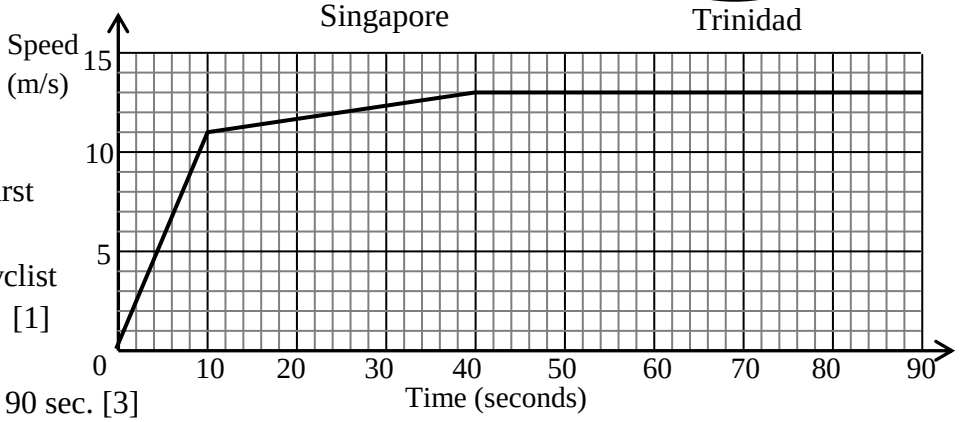
7 [P1 May/June 2003 Q 24]

The speed-time graph shows the Performance of a cyclist during the first 90 seconds of a race.

(a) Calculate the acceleration of the cyclist during the first 10 seconds. [1]

(b) Calculate the distance, in metres, Travelled by the cyclist in the first 90 sec. [3]

(c) Calculate the time taken for the cyclist to travel 1 km. [2]



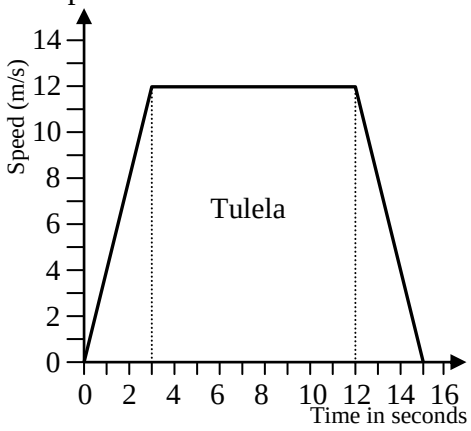
8 [P2 NSSC 2013 Q 4]

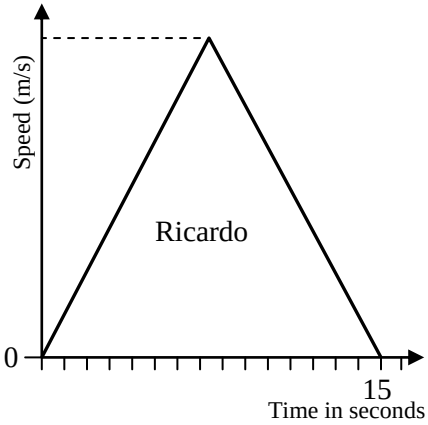
A plane took two hours and 10 minutes to fly from Johannesburg to Windhoek. The plane arrived in Windhoek at 23 : 05. At what time did the plane depart from Johannesburg? [1]

9 [P2 NSSC 2013 Q 20]

The graphs show the speeds of two cyclists, Tulela and Ricardo, during the Desert Dash competition at Swakopmund.

Tulela accelerated to 12 m/s in the first 3 seconds, travelled at a steady speed for 9 seconds and then Slowed to a stop a further 3 seconds.





Ricardo accelerated to his maximum speed v m/s, and slowed to a stop. Both cyclists travelled the same distance over the 15 seconds.

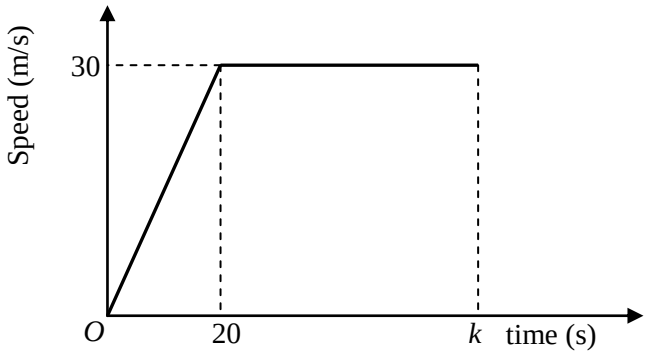
Calculate the maximum speed v for Ricardo. [5]

10 [P2 NSSC 2014 Q 1]

The speed of a racing car is 256 km/h. Change this speed in metres per second. [2]

11 [P2 NSSC 2014 Q 16]

The diagram shows a speed-time graph for the first k seconds of a motion of a cheetah chasing a gazelle in a game park.



(a) For the first 20 seconds, calculate

(i) the cheetah's acceleration, [1]

(ii) the distance moved by the cheetah. [1]

(b) The total distance travelled by the cheetah in the first k seconds is 960 m. Find the value of k. [3]

Section 7 Variation and substitution

1 [P1 May June 2006 Q 6]

It is give that $p = \frac{12}{\sqrt{q}}$

(a) Describe the relationship between p and q in words by completing the sentence : p is …….. proportional to the square root of q. [1]

(b) Calculate q when $p = 4$. [1]

2 [P1 Oct/Nov 2011 Q 13]

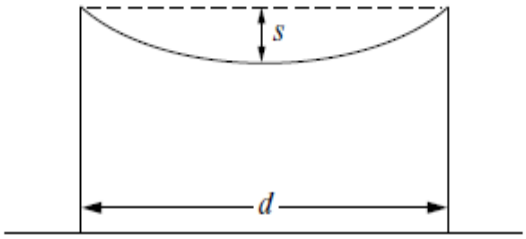
y is inversely proportional to x. The table shows some values of x and y.

x	3	4	q	n
y	20	p	5	m

(a) Find a **(b)** Find q **(c)** Express m in terms of n. each [1]

3 [P1 May June 2003 Q 21]

Two vertical posts of the same height stand on horizontal ground.
The distance between the posts is d centimeters.
When a wire of length w centimeters is suspended between the posts, the sag in the middle is s centimeters.



The sag is given by the formula: $s = \sqrt{\frac{3d(w-d)}{8}}$

(a) Find s when $d = 800$ and $w = 803$ [1]

(b) Express w in terms of d and s. [3]

4 [P2 NSSC 2007 Q 18]

The force of attraction, F Newton, between two magnets varies inversely as the square of the distance, d cm, between them. When the magnets are 2 cm apart, the force of attraction is 32 Newton.

(a) Find an equation connecting F and d. [3]

(b) Calculate d when $F = 2$. [1]

5 [P2 NSSC 2015 Q 7]

It is given that x varies inversely to the square root of y. If $x = 3$, $y = 25$,

(a) find an equation connecting x and y. [2]

(b) Hence, calculate y when $x = -2$ [3]

Section 8 Mensuration

1 [P1 May June 2006 Q 9 (b)]

The thickness of an oil film is 0.000 004 cm. The oil covers an area of 20 m^2.
Calculate the volume of the oil in cubic centimeters. [2]

2 [P1 Oct/Nov/2011 Q 3]

Exactly 9 litres of liquid filled 60 identical bottles.

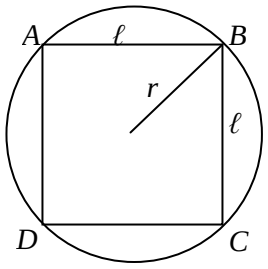
(a) How many litres filled 40 bottles? [1]

(b) How many of these bottles are filled using 750 ml of liquid? [1]

3 [P1 May/June 2003 Q 8 (a)] Add together 37 kilograms and 40 grams. Give your answer in kilograms. [1]

4 [P1 May June 2003 Q 19]

The vertices of the square $ABCD$ lie on a circle of radius r cm.



(a) Show that the length, ℓ cm, of a side of the square is $r\sqrt{2}$ cm.

(b) By comparing the perimeter of the square and the circumference of the circle, or otherwise, show that $\sqrt{2} < \frac{1}{2}\pi$.

(c) What special kind of numbers are $\sqrt{2}$ and π?

5 [P2 May/June 2005 Q 7]

[The volume of a pyramid is $\frac{1}{3} \times$ base area $\times$ height and the volume of a sphere is $\frac{4}{3} \times \pi \times r^3$]

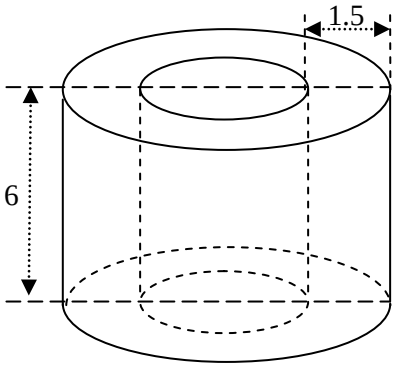
Morph made several different objects from modeling clay. He used 500 cm^3 of clay for each object.

(a) He made a square based-cuboid of height 2 cm. Calculate the length of a size of the square. [2]

(b) He made a pyramid with a base area of 150 cm^2. Calculate the height of the pyramid. [2]

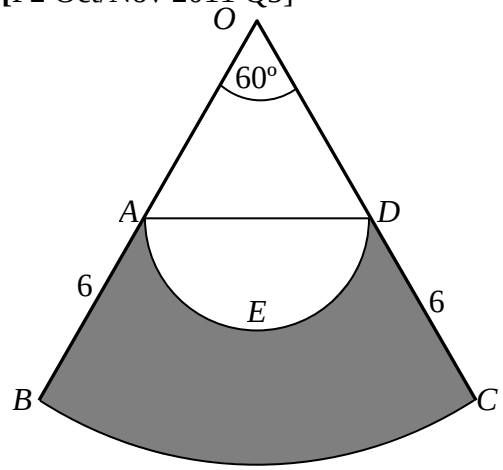
(c) He made a sphere. Calculate the radius of the sphere. [2]

(d) He wrapped clay around the curved surface of a hollow cylinder of height 6 cm. The thickness of the clay is 1.5 cm. Calculate the radius of the hollow cylinder. [4]



(e) He made a cone. Then he cut through the cone parallel to the base, to obtain a small cone and a frustum. The height of the small cone is two fifths of the height of the full cone. Use a property of the volumes of similar objects to calculate the clay in the small cone. [2]

6 [P2 Oct/Nov 2011 Q5]



In the diagram, *OBC* is the sector of a circle with centre *O* and $\angle BOC = 60°$. *A* and *D* are midpoints of *OB* and *OC* respectively and *AB* = *DC* = 6 cm. *AED* is a semicircle with diameter *AD*.

(a) Show that *AD* = 6 cm. [1]

(b) The length of arc *BC* = $n\pi$ cm.

(i) Find *n*. [2]

(ii) Find $\frac{\text{the length of arc } AED}{\text{the length of arc } BC}$ [2]

(c) Find the area of sector *BOC*. [2]

(d) Hence find the area of the shaded region. [3]

7 [P2 Oct/Nov 2007 Q 6]

(a) Diagram I shows a design which consists of 7 congruent circles drawn inside a large circle. The circles touch at all points shown.

(i) State the order of rotational symmetry of this design. [1]

(ii) In **diagram II** (see next page), two sections have been shaded. each small circle has a radius of 5 cm.

Calculate **(a)** the area of the large circle

(b) the shaded area.

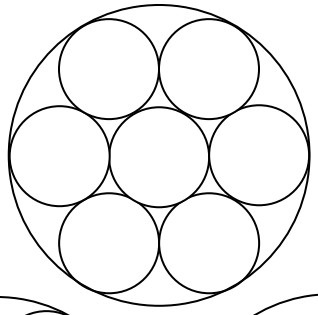


Diagram I

(b) In **diagram III,** circles, centres *O*, *A* and *B* are shown, together with the same shaded area as in **(a).** *O* is the centre of the large circle.

(i) Write down angle *AOB*. [1]

(ii) Calculate the total <u>perimeter</u> of the shaded area. [4]

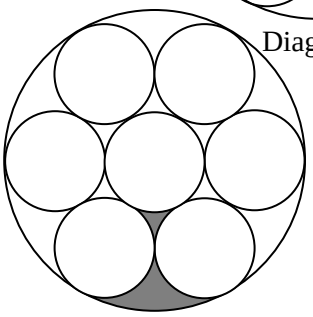


Diagram II

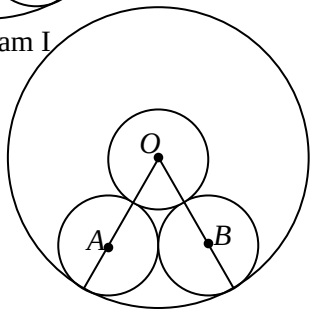
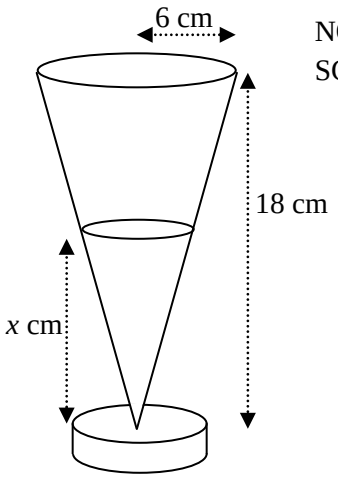


Diagram III

8 [P4 NSSC 2009 Q 4]

A water funnel has a radius of 6 cm and a height of 18 cm as shown in the diagram to the right.



NOT TO SCALE

(a) calculate the capacity of the funnel. [2]

(The volume of a cone with radius r and height h is $\frac{1}{3}\pi r^2 h$)

(b) After a heavy shower of rain the funnel is full to the height of 9 cm. If the funnel was empty before the shower, calculate the volume of water in the funnel. [2]

(c) If the height of the water in the funnel is x cm

(i) find the radius of the water in terms of x, [1]

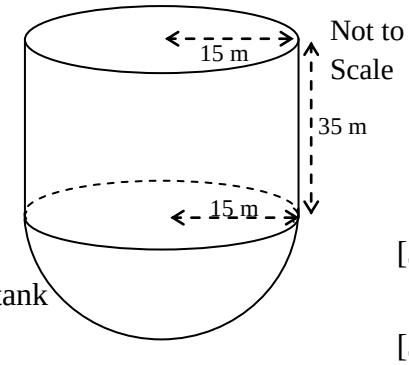
(ii) find the formula for the volume of water, in terms of x and π in its simplest form, [3]

(iii) show that, when $x = 9$ cm, your formula gives the same answer as in **(b)** [2]

9 [P4 NSSC 2013 Q 2]

The diagram to the right shows a water tank used to collect rain water on a farm. The tank consists of a cylinder of radius 15 m and a height of 35 m, which is attached to a hemisphere of radius 15 m. The hemisphere forms the base of the tank which is closed.

[surface area of a sphere is $4\pi r^2$ and the volume of a sphere is $\frac{4}{3}\pi r^3$]

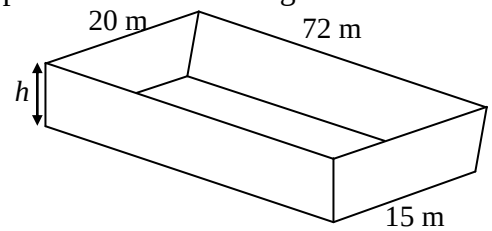


Not to Scale

(a) Calculate the total surface area of the outside of the tank. [3]

(b) (i) The rain fell throughout the night and the following morning the tank is for $\frac{3}{4}$ full. Calculate the number of litres of water in the tank. [3]

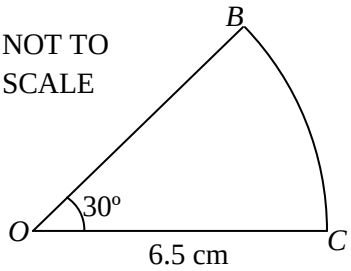
(ii) The water drains from the tank at a rate of 1000 litres per second into a trough. Calculate the time, in hours, to empty the tank. [2]



(c) The trough is a prism whose cross section is a trapezium. It the water from a full tank fills the trough, calculate the height of the trough. [3]

10 [P2 NSSC 2013 Q 18]

OBC is a sector of a circle with centre *O* and of radius 6.5 cm. Angle *BOC* = 30º. Calculate



NOT TO SCALE

(a) the area of the sector, [2]

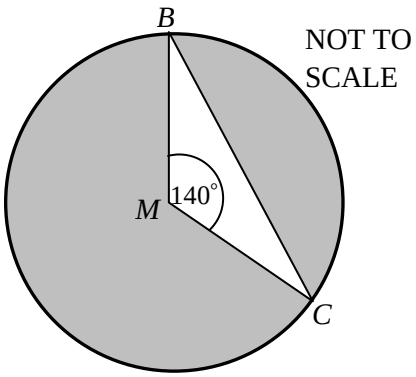
(b) the perimeter of the sector. [2]

11 [P2 NSSC 2014 Q 9]

A cylindrical syringe is to be used to draw a sample of blood from a patient in a hospital. If the radius of the syringe is 2.5 cm and the length of the syringe is 15 cm, calculate the volume of blood in the syringe when it is full. [2]

12 [P2 NSSC 2014 Q 15]

The diagram shows a circle, centre *M,* radius 60 mm.
The points *B* and *C* lie on the circle such that angle *BMC* = 140°.

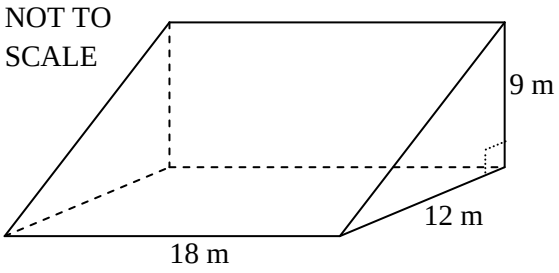


(a) Calculate the length of chord *BC.*
Give your answer correct to one decimal place. [4]

(b) Calculate, to the nearest whole number, the shaded area. [5]

13 [P4 NSSC 2014 Q 3] *The ramp shown in the official exam paper has measurements in cm; this seems to be incorrect; I will show the same ramp with measurements in meters; it will be a rather high ramp. The authors may have meant to draw a model but no scale information is given.*

The diagram shows a hollow shape which is used to built a ramp for skateboarders to jump over a pit.
To build the ramp, the hollow shape is filled with soil and then compacted. The soil costs N$25 per m^3.

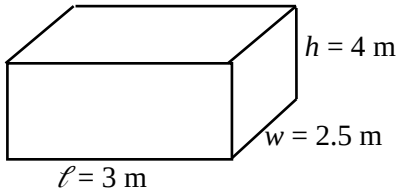


(a) What is the name of the shape that will be used as a ramp? [1]

(b) Calculate the volume of the ramp. [2]

(c) A compacter costs N$100 per hour to hire and it will take 8 hours to compact the ramp.
How much will the whole process cost to compact the ramp? [4]

(d) A lorry with a loading bed in the shape of a cuboid shown to the right will be used to transport the soil to the ramp.
Determine how many lorry loads will be needed to fill the ramp. [3]



14 [P4 NSSC 2015 Q 1 (d)]

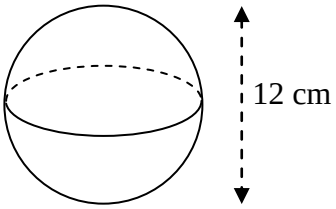
(i) A small box of hake is in the shape of a cuboid of dimensions 10 cm by 10 cm by 5 cm. The small boxes of hake are packed into a large container in the shape of a cuboid of dimensions 3 m by 5 m by 3m. Find the largest number of small boxes that can be fitted into the large container. [3]

(ii) The cost of the small box of hake was €2.33. Calculate the cost of one large container full of small boxes, in Namibian dollars if N$13.21 = €1. [2]

(iii) The company had to paint the entire outside of the container with a rust free paint.
Calculate the total surface area that had to be painted. [2]

15 [P2 NSSC 2016 Q 9]

A sphere has a **diameter** of 12 cm.



(a) Find the volume of the sphere. [Volume of a sphere is $\frac{4}{3}\pi r^3$] [2]

(b) Another sphere has a total surface area of 225 cm^2. Find the radius of the sphere. [3]
[Surface area of a sphere of radius *r* is $4\pi r^2$]

Section 9 Inequalities

1 [P1 May June 2006 Q 10 (a)]

(a) Find the smallest integer k which satisfies $7k \geq 36$ [1]

(b) Find the largest integer n which satisfies $3n - 1 < 26$. [1]

2 [P1 Oct/Nov 2011 Q 6]

(a) Solve the inequality $2(4 - x) < x - 10$ [1]

(b) Find the smallest integer n such that $3n > -17$ [1]

3 [P1 May June 2003 Q 13 (b) & (c)]

(a) Solve the inequality $7 - y < 9$ [1]

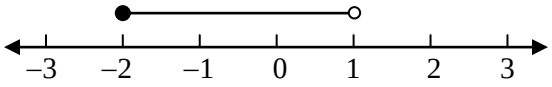
(b) Write down the least integer value of z for which $z > -4$ [1]

4 [P2 NSSC 2009 Q 15]

Solve the inequality and write down all the possible integers values of n. $-2 \leq 1 + 2n \leq 5$ [3]

5 [P2 NSSC 2007 Q 9]

Write the following as an inequality.



[2]

6[P2 NSSC 2016 Q11]

(a) Solve the inequality $x - 10 \leq 2(x - 1) < x$. [3]

(b) Sketch a number line to represent your solutions to part **(a)** [2]

Section 10 Simultaneous equations

1 [P1 May June 2006 Q 11]

Solve the simultaneous equations $3x = 7y$

$12y = 5x - 1$ [3]

2 [P1 Oct/Nov 2011 Q 19]

Solve the simultaneous equations $2x + 3y = 0$

$x + 4y = -15$ [3]

3 [P1 May June 2003 Q 11]

Solve the simultaneous equations $4x - y = 9$,

$2x - 3y = -23$. [3]

4 [P2 Oct/Nov 2011 Q 2 (b)]

Solve the simultaneous equations $3x + 4y = 1$

$5x - 8y = 9$ [3]

5 [P4 NSSC 2014 Q 6 d]

Solve the equations $y = 2x^2 + 2x - 6$ and $y = 3x + 4$ simultaneously. [4]

6 [P2 NSSC 2016 Q 12]

Solve the simultaneous $3a - b = 9$

$2a + 2b = 14$ [3]

7 [P4 NSSC 2016 Q10 (b)]

Solve simultaneously

$xy = 20$

$x - 2y = -3$ [6]

Section 11 Symmetry

1 [P1 May June 2006 Q 16 (a)]

A prism has a cross section which is a regular hexagon.

How many planes of symmetry does the prism have? [1]

2 [P1 May June 2003 Q 16]

(a) State the order of rotational symmetry of a regular decagon. [1]

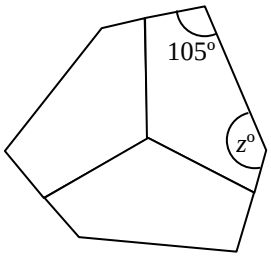
(b) Write down those letters of the word **AMBULANCE** which have a vertical axis of symmetry. [1]

(c) *A* and *B* are two points in space which are 10 cm apart. Describe fully the locus of points in three dimensions that are 3 cm from the line which starts at *A* ands end at *B*. [2]

3 [P2 May/June 2005 Q 3(b)]

This hexagon has rotational symmetry of order 3.

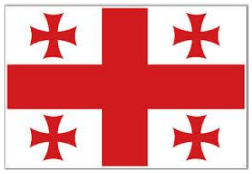
Calculate the value of *z*. [2]



4 [P2 NSSC 2013 Q 8]

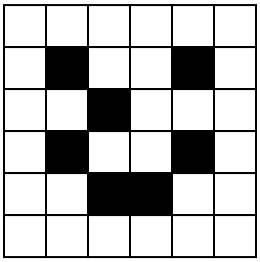
(a) Write down the number of line of symmetry: [1]

(b) Write down the order of rotational symmetry for the given image. [1]

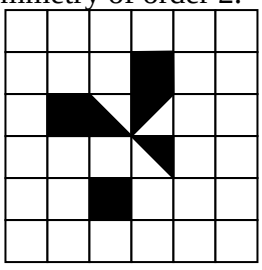


5 [P2 NSSC 2014 Q 8]

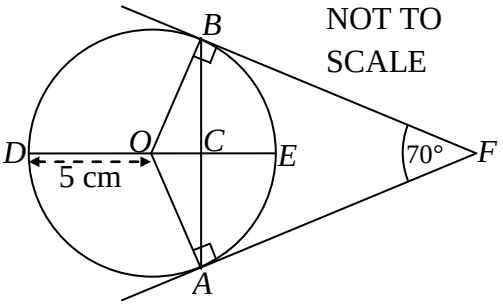
(a) Shade **one more square** so that the pattern has only one line of symmetry. [1]



(b) Shade **one more triangle** and **one more square** so that the shape has rotational symmetry of order 2. [2]



6 [P2 NSSC 2016 Q13]



The diagram shows a circle, centre *O*, radius 5 cm. The points *A*, *E*, *B* and *D* lie on the circumference of the circle.
The tangents to the circle at the points *A* and *B* meet at point *F*.
Line *DOCE* is perpendicular to line *ACB*.
Angle *AFB* = 70° and *OAF* = *OBF* = 90°.

(a) Find **(i)** angle *AOB*, [2]
(ii) angle *BOC* [2]
(iii) length, *OC*, giving your answer in 2 significant figures. [2]

(b) Give a reason why angle *OBF* and angle *OAF* are 90°. [1]

(c) How many lines of symmetry does shape *AOBF* has? [1]

(d) Write down the order of rotational symmetry of shape *AFBD*. [1]

Section 12 Solving Equations

1 [P1 May June 2006 Q 17]

(a) Given that $x = 6$ is a solution of $\frac{x^2}{3} + k = 0$, find the value of k. [1]

(b) Solve $2y^2 - 3y - 2 = 0$. [2]

2 [P1 Oct/Nov 2011 Q 23 (b)]

Solve the equation $2y^2 + 29y - 15 = 0$ [3]

3 [P1 May June 2003 Q 5(b)]

Solve $(x + 1)(3x - 2) = 0$ [1]

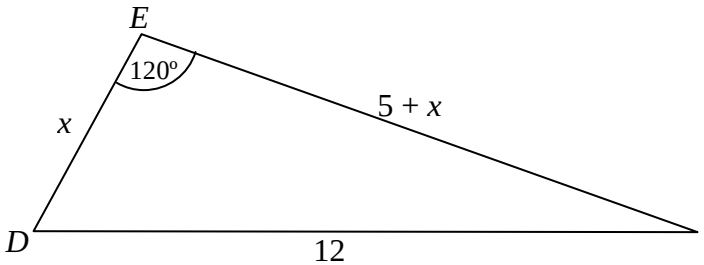
4 [P1 May June 2003 Q 13(a)]

Solve the equation $\frac{5}{x+1} = 4$ [1]

5 [P2 Oct/Nov 2011 Q 2 (a)]

Solve $5t(3t + 7) = 0$ [1]

6 [P2 Oct/Nov 2011 Q 9 (b)]



In the diagram, *DF* = 12 cm, *DE* = *x* cm and *EF* = (5 + *x*) cm

(a) Form an equation in terms of *x* and Show that it reduces to $3x^2 + 15x - 119 = 0$ [3]

(b) Solve the equation $3x^2 + 15x - 119 = 0$, giving your answer correct to 3 decimal places. [4]

(c) Find the length of *EF* in millimetres, correct to the nearest millimetre. [1]

7 [P4 2013 Q 3]

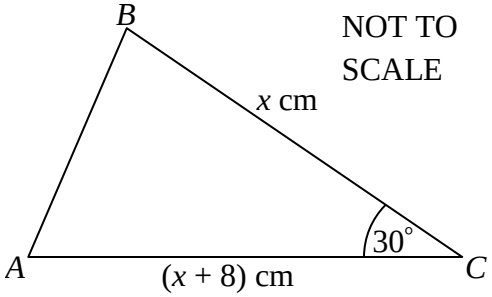
(a) Write as a single fraction $\frac{3}{x-1} - \frac{2}{2x-1}$ [3]

(b) (i) Factorise $x^2 + x - 6$ [2]

(ii) Simplify $\dfrac{x^2+x-6}{x^2-5x+6}$ [3]

(c) Solve the equation $7x^2 = 11 - 12x$. Show all your working and give your answer correct to 2 decimal places. [4]

8 [P4 NSSC 2015 Q 5]



NOT TO SCALE

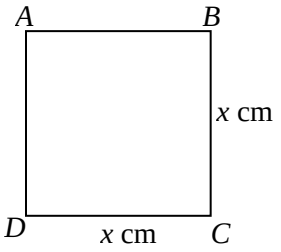
The diagram shows a triangle ABC in which angle $ACB = 30^\circ$, $BC = x$ cm and $AC = (x + 8)$ cm.

(a) If the area of triangle ABC is 12 cm^2, write down an equation in terms of x, and show that it simplifies to $x^2 + 8x - 48 = 0$. [3]

(b) Solve the equation $x^2 + 8x - 48 = 0$, and find the length of BC. [4]

(c) If $BC = 2$ cm, find the length of AB, giving your answer to the nearest whole number. [4]

9 [P2 NSSC 2016 Q14]



(a) When each side of a square is reduced by 3 cm, the area is reduced by 39 cm^2. Find thee length of the side, x cm, of the original square. [3]

(b) A different square has a side of $(x + 2)$ cm and an area of 20 cm^2 .

(i) Write down an equation in x and show that it simplifies to $x^2 + 4x - 16 = 0$ [2]

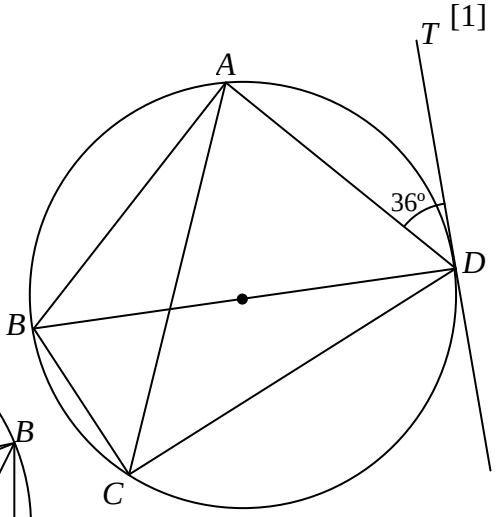
(ii) Solve the equation $x^2 + 4x - 16 = 0$.
Show **all** your working and give your answer correct to 2 decimal places. [4]

(iii) Find the side length of the square. [1]

Section 13 Angles in a circle

1 [P1 May June 2006 Q 18]

A, B, C and D are points on a circle with BD as diameter.
TD is a tangent at D and $\angle TDA = 36^\circ$.
Find **(a)** $\angle ADB$ **(b)** $\angle ABD$ **(c)** $\angle ACD$ each [1]



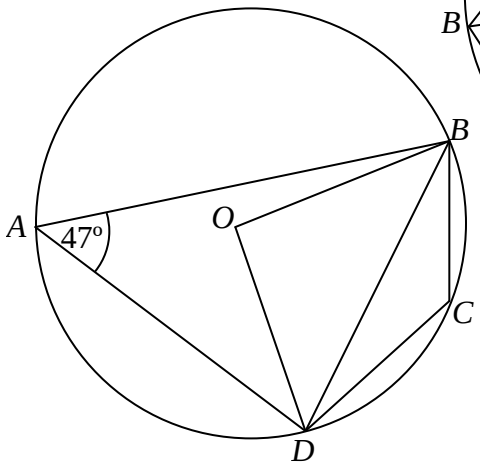
2 [P1 Oct/Nov 2011 Q 14]

In the diagram A, B, C and D are points on a circle, centre O
$\angle BAD = 47^\circ$.
Find

(a) $\angle BOD$ [1]

(b) $\angle BCD$ [1]

(c) $\angle OBD$ [1]

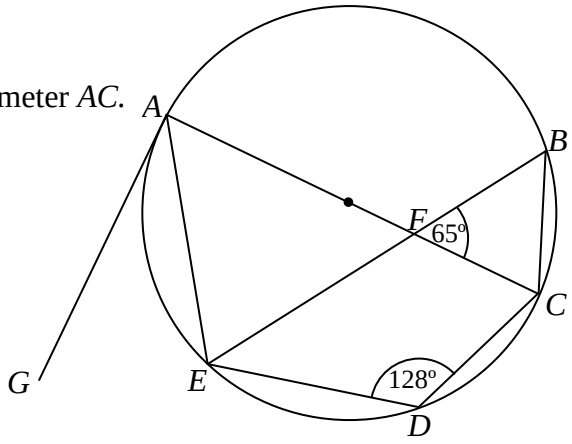


3 [P1 May June 2003 Q 14]

The points *A, B, C, D* and *E* lie on the circle with diameter *AC*.
EB and *AC* meet at *F*.
GA is tangent to the circle at *A*.
$\angle CDE$ 128º and $\angle BFC$ = 65º.
Calculate

(a) $\angle GAE$ [2]

(b) $\angle AEB$ [1]



4 [P2 Oct/Nov 2011 Q 7 (b)]

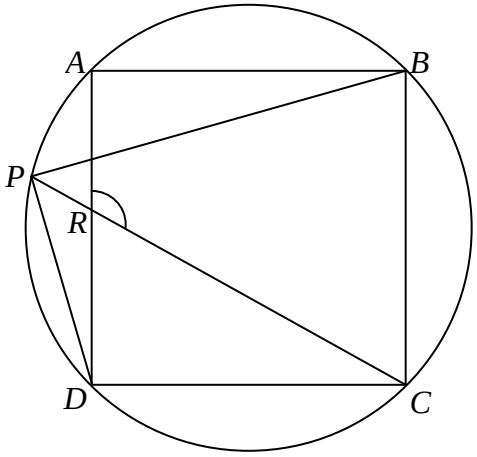
In the diagram, *ABCD* is a square.
The point *P* lies on the circle through *A, B, C* and *D*.

(a) (i) Explain why $\angle APC = 90^\circ$

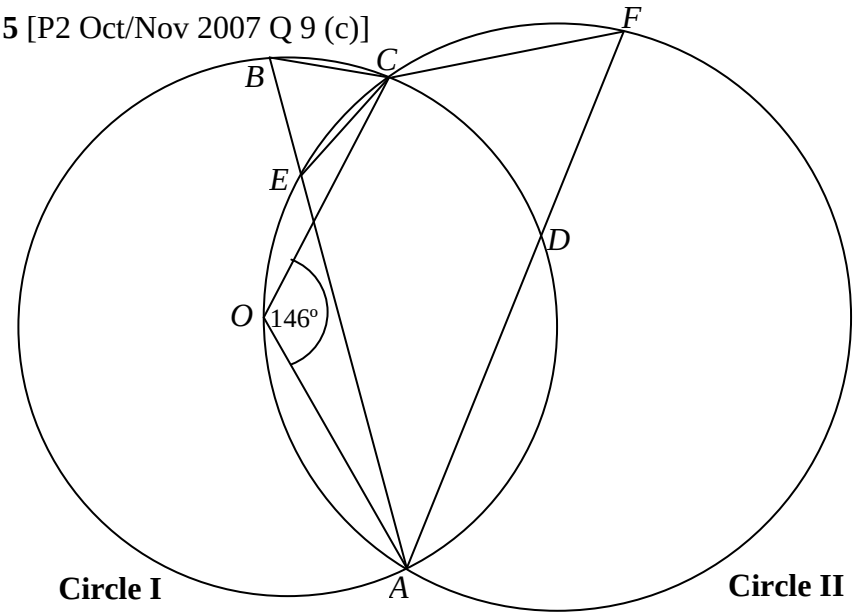
(ii) Explain why $\angle APB = \angle BPC$

(iii) Hence find $\angle APB$

(b) *PC* and *AD* intersect at *R* and it is given that $\angle ARC = 127^\circ$
Find $\angle PDC$



5 [P2 Oct/Nov 2007 Q 9 (c)]



Circle I **Circle II**

Points *A, B, C* and *D* lie on **Circle I**.
O is the centre of **Circle I**.
Points *A, O, E. C* and *F* lie on **Circle II**.
AEB and *ADF* are straight lines.
$\angle AOC = 146^\circ$.
Giving reasons, write down:

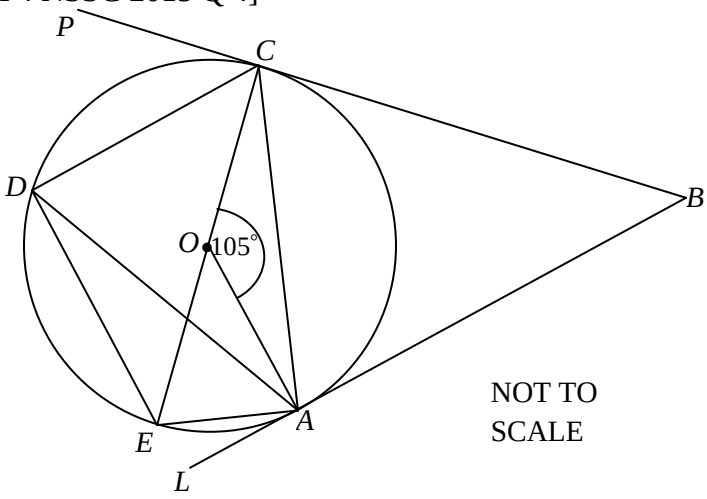
(a) $\angle CEA$

(b) $\angle CBA$

(c) $\angle CFA$

(d) $\angle DCF$

6 [P4 NSSC 2015 Q 4]



NOT TO SCALE

The diagram shows a cyclic quadrilateral, *ACDE* with centre *O*. Lines *LAB* and *BCP* are tangents to the circle and they meet at point *B*. Angle *AOC* = 105°.

(a) Find the following angles, giving <u>reasons</u> for each answer.

(i) Angle *ADC* [2]

(ii) Angle *OCP* [2]

(iii) Angle *EAC* [2]

(b) Find

(i) Angle *AEC* [1]

(ii) Angle *ABC* [2]

(iii) Angle *ACE* [2]

Section 14 Changing the subject of a formula and substitution

1 [P1 May/ June 2006 Q 19]

$C = \frac{5}{9}(F - 32)$

(a) Calculate C when $F = -4$ [1]

(b) Express F in terms of C. [2]

2 [P2 May/June 2005 1 (c)]

Given that $y = 18 + 3x^2$,

(a) find the value of y when $x = -2$. [1]

(b) find the values of x when $y = 93$. [2]

(c) express x in terms of y. [2]

3 [P2 May/June 2005 Q 10]

A route up a mountain is 20 km long. John followed this route at an average speed of x km/h.

(a) Write down an expression in terms of x, for the number of hours he took to walk up the mountain. [1]

(b) He came down the mountain by a different route. The length of this route was 25 km. His average speed coming down the mountain was 2 km/h greater than his average speed going up the mountain. Write down an expression in terms of x, for the number of hours he took to walk down. [1]

(c) It took John 1½ hours less to come down than to go up. Write down an equation in x, and show that it simplifies to $3x^2 + 16x - 80 = 0$ [3]

(d) Solve the equation $3x^2 + 16x - 80 = 0$, giving your answer in correct to 3 decimal places. [4]

(e) Calculate, correct to the nearest minute, the **total** time John took to go up and come down the mountain [3]

4 [P2 Oct/Nov 2007 Q 2 (a)]

It is given that $x = a + \sqrt{a^2 + b^2}$

(a) Calculate x when $a = 0.73$ and $b = 1.84$. Give your answer correct to 2 decimal places. [2]

(b) Express b in terms of x and a. [3]

5 [P2 NSSC 2013 Q 10]

It is given that $P = \frac{(a+2)(2a-1)}{3-a}$, for which values of a will P be

(a) equal to zero, [2]

(b) undefined. [1]

6 [P4 NSSC 2014 Q 5c]

Make x the subject of the formula $p = 4m\sqrt{\frac{4}{x}}$ [3]

7 [P2 NSSC 2016 Q 5]

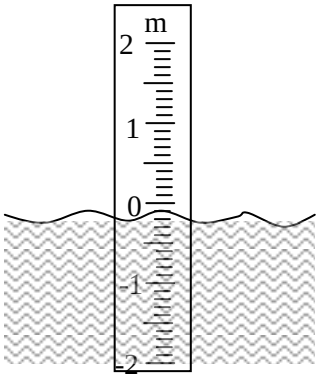
The formula $A = P\left(1 + \frac{r}{100}\right)^n$ is used to calculate compound interest. Express n in terms of A, P and r. [3]

8 [P4 NSSC 2016 Q 10 (a)]

Make x the subject of the formula $y = \sqrt{x+1}$ [2]

Section 15 Statistics

1 [P1 May June 2006 Q 20]



The diagram shows a gauge for measuring the water level in a reservoir.

Reading, in meters, taken over a certain period were as follows:

–2.3, –1.6, –0.4, 0.1, –0.5, 0.3, –1.2

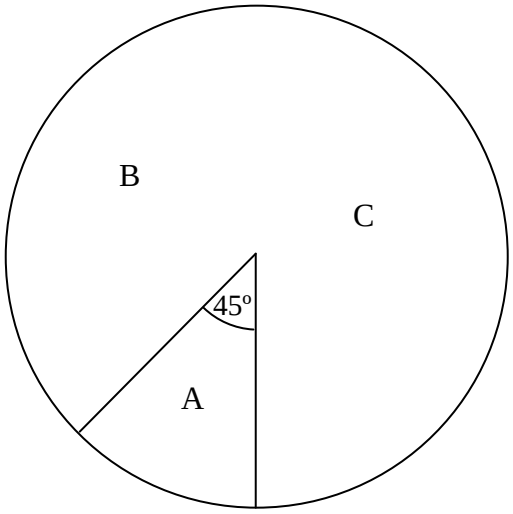
For these readings

(a) find the difference, in meters, between the highest and lowest levels,

(b) find the median,

(c) calculate the mean.

2 [P1 Oct/Nov 2011 Q 15]



In a survey, some people were asked which of the three songs, labeled A, B and C they liked best.

The diagram shows part of a pie chart illustrating the results.

The angle of the sector that represents the people who liked song C best is 168º.

(a) Complete the pie chart. [1]

(b) Expressing your answer in its lowest terms, find the fraction of people in the survey who liked C best. [1]

(c) Given that 30 people liked A best, calculate the number of people in the survey. [1]

3 [P1 oct/Nov 2011 Q 16]

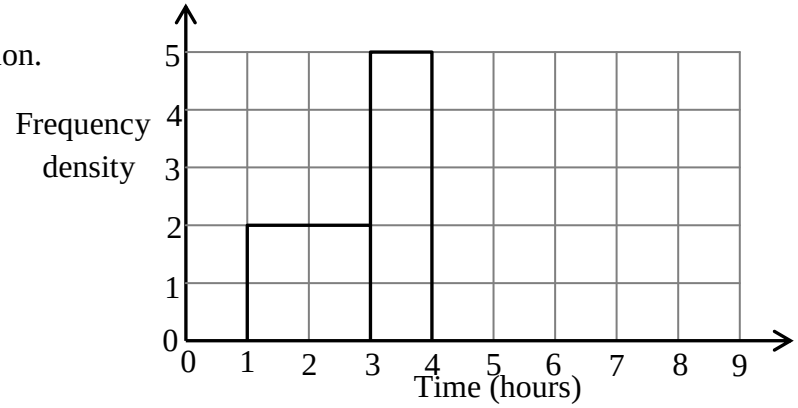
The distribution of the lengths of time taken by an engineer to repair some washing machines is given in the table

Time (t hours)	$1 < t \leq 3$	$3 < t \leq 4$	$4 < t \leq 5$	$5 < t \leq 8$
Frequency	k	5	4	3

The histogram represents some of this information.

(a) Find k [1]

(b) Complete the histogram. [2]



4 [P1 oct/Nov 2011 Q 24]

The table shows the number of goals scored by 40 football teams during one weekend.

Number of goals	0	1	2	3	4	5	6
Number of teams	16	6	6	6	4	0	2

Find **(a)** mode [1]

(b) median [1]

(c) mean [2]

5 [P1 May June 2003 Q 25]

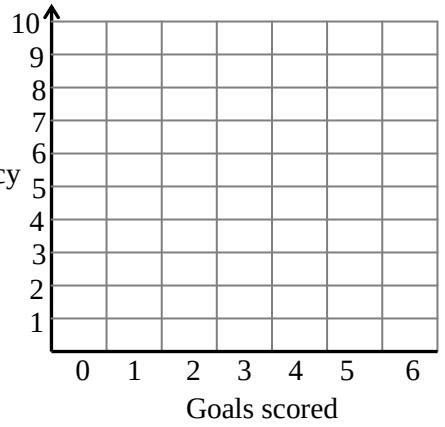
The number of goals scored in 20 football matches were:

5	0	5	4	1	0	5	5	1	3
4	5	0	0	5	5	3	2	5	4

(a) (i) Complete the table in the answer space. [1]

No of goals scored	0	1	2	3	4	5
No of matches (freq)						

(ii) Using the axes to the right , represent the information in a bar chart. [2]



(b) State the median [1]

(c) Calculate the mean number of goals. [2]

6 [P2 May/June 2005 Q 5]

Sweet packets contain sweets of different colours.

The number of yellow sweets in each of 25 packets was recorded.

The table below shows the results

Number of yellow sweets	0	1	2	3	4	5
Frequency	8	5	5	4	2	1

For this distribution

(a) write down the mode [1]

(b) write down the median [1]

(c) calculate the mean [2]

7 [P2 Oct/Nov 2011 Q 10]

The distribution of the masses of 140 eggs is given in the table below.

Mass (m grams)	$35 < m \leq 40$	$40 < m \leq 45$	$45 < m \leq 50$	$50 < m \leq 55$	$55 < m \leq 60$	$60 < m \leq 70$
Number of eggs	15	20	30	35	28	12

(a) Using a scale of 1 cm to represent 5 grams, draw a horizontal axis for $30 \leq m \leq 70$

Using a scale of 1 cm to 5 units, draw a vertical axis to represent frequency density.

Draw a histogram to represent the information in the table. [3]

(b) (i) complete the cumulative frequency table below. [1]

Mass (m in grams)	$m \leq 35$	$m \leq 40$	$m \leq 45$	$m \leq 50$	$m \leq 55$	$m \leq 60$	$m \leq 70$
Cumulative frequency	0	15					140

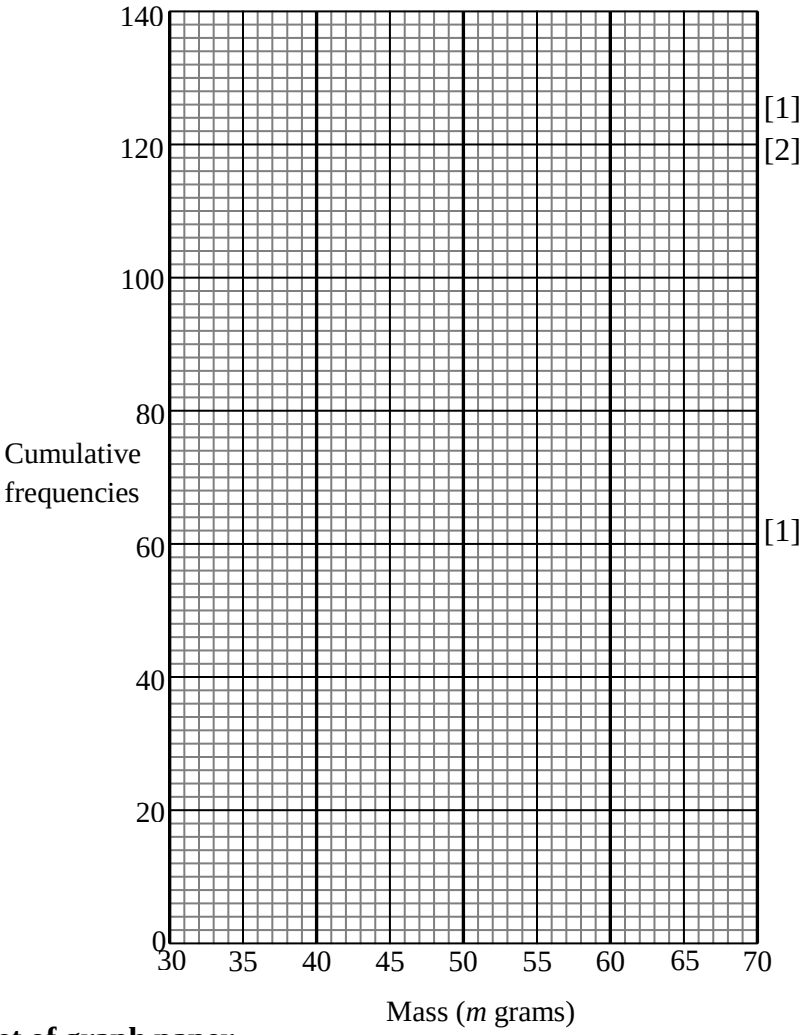
(ii) On the grid below, draw a smooth cumulative frequency curve to represent this information. [3]

(c) Use your graph to find out

(i) median mass of the eggs [1]

(ii) the Interquartile range [2]

(d) The 12 eggs with the greatest mass are classed as extra large.
The 30 eggs with the least mass are classed as small.
Use your graph to find an estimate for the smallest difference in mass between an extra large egg and a small egg. [1]



8 [P2 Oct/Nov 2007 Q 10]

Answer the whole of this question on a sheet of graph paper

Potatoes are sold in sacks. One sack, picked at random, contained 260 potatoes.
The masses, in grams, of the potatoes in this sack are summarized in the table below.

Mass (m grams)	$50 < m \leq 100$	$100 < m \leq 150$	$150 < m \leq 200$	$200 < m \leq 250$	$250 < m \leq 300$	$300 < m \leq 350$
Frequency	4	56	84	76	36	4

(a) (i) Calculate an estimate of the total mass of potatoes in this sack. [2]

(ii) Calculate an estimate of the mean mass, in grams, of a potato. [1]

(b) (i) Copy and complete the cumulative frequency table given below [1]

Mass (m grams)	$m \leq 50$	$m \leq 100$	$m \leq 150$	$m \leq 200$	$m \leq 250$	$m \leq 300$	$m \leq 350$
Cumulative frequency	0	4	60				260

(ii) Using a scale of 2 cm to represent 50 grams, draw a horizontal axis for masses between 0 and 350 grams.
Using a scale of 2 cm to represent 50 potatoes, draw a vertical axis for values from 0 to 300.
On your axes, draw a smooth cumulative frequency curve to illustrate this information. [3]

(iii) Use your curve to find

(a) the median [1]

(b) the Interquartile range. [2]

(c) The organizers of a braai expect to sell 500 baked potatoes. Each potato should have a mass greater than 200 g. Estimate the number of sacks of potatoes they will need. [2]

9 [P4 NSSC 2013 Q 9]

(a) A rugby team scored the following number of points in a season:

15, 18, 3, 12, 21, 18, 3, 12, 6, 24, 42, 18

(i) Calculate the mean score over the season. [2]

(ii) Calculate the median score for all the games. [2]

(iii) Which of these two scores would the coach use to show the team that they had a bad season? [1]

(b) During an athletics meeting the distances of 40 javelin throwers were recorded.

Distance (m)	$0 \leq m \leq 20$	$20 \leq m \leq 40$	$40 \leq m \leq 60$	$60 \leq m \leq 80$	$80 \leq m \leq 100$
Frequency	4	9	15	10	2

(i) Draw a cumulative frequency table using the above data. [3]

(ii) Draw a cumulative frequency curve using the above data. [4]

(iii) The top 15% of the throwers made it to the final. Using the curve estimate the qualifying distance. [1]

(iv) Calculate the inter-quartile range of the throws in the athletics meeting. [2]

10 [P2 NSSC 2013 Q 3]

The table shows the daily maximum temperatures recorded over a 5 day period in Vancouver.

day	1	2	3	4	5
Temperature (°C)	–20	–5	1	0	–23

(a) Write down the highest of these temperatures. [1]

(b) The range of these temperatures. [1]

11 [P2 NSSC 2013 Q 9]

A company recorded the number of email messages each day over a period of 100 days.

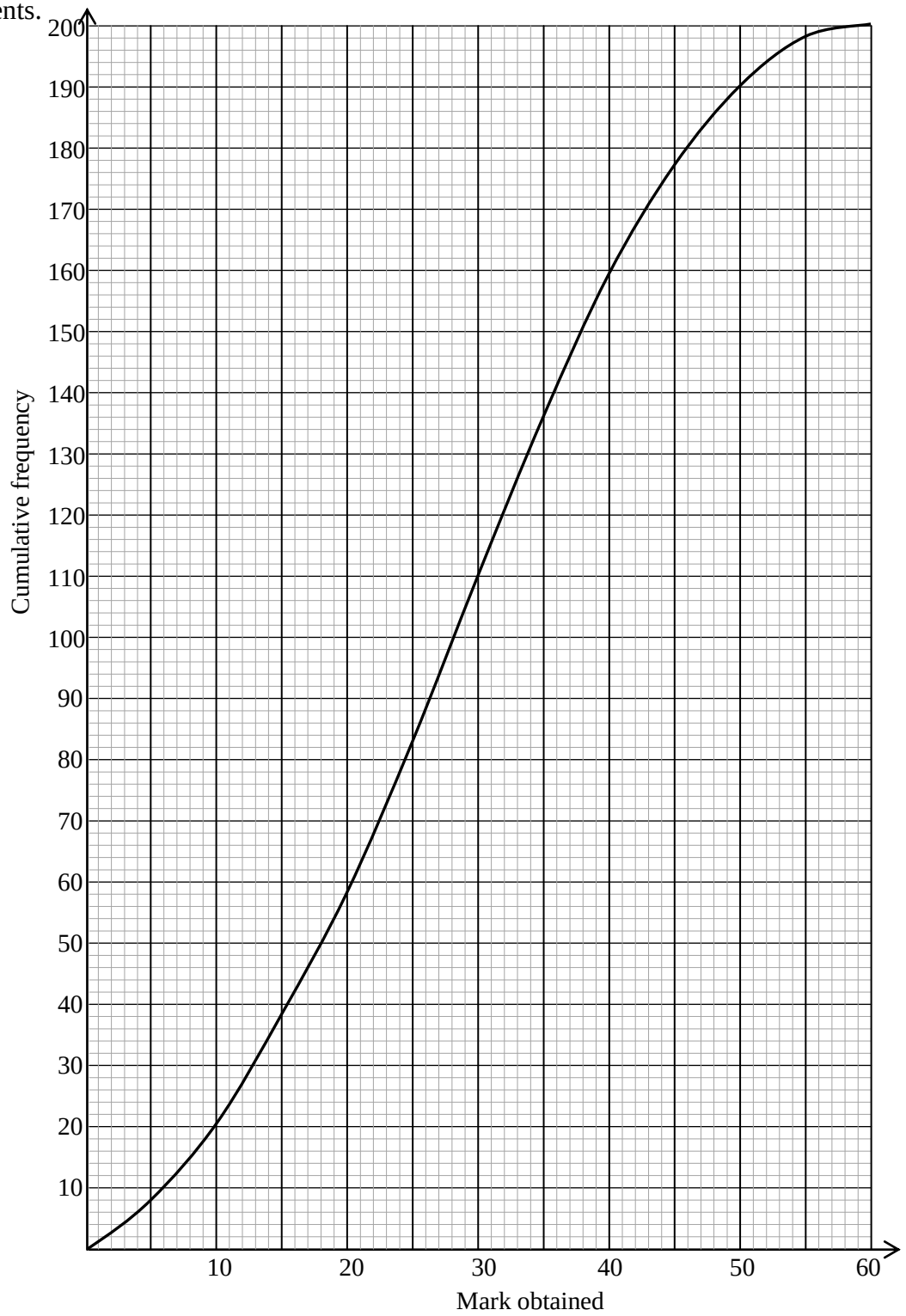
Number of email messages	$10 \leq m < 20$	$20 \leq m < 30$	$30 \leq m < 40$	$40 \leq m < 60$
Number of days	9	23	38	30

(a) Estimate the mean number of email messages. [3]

(b) Estimate the number of days on which more than 30 email messages sent. [1]

12 [P2 NSSC 2014 Q 19]

The cumulative frequency curve below shows the marks, out of 60 obtained in an examination by a group of 200 students.



(a) Use the cumulative frequency curve to complete the frequency table below.

Mark x	$0 \leqslant x < 20$	$20 \leqslant x < 30$	$30 \leqslant x < 40$	$40 \leqslant x < 50$	$50 \leqslant x < 60$
Number of students	58				

[2]

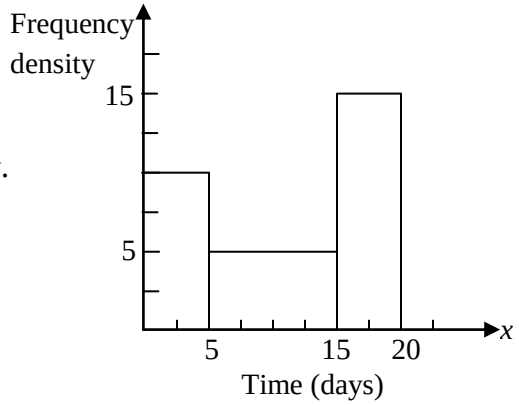
(b) Find the median mark obtained in the examination [1]

(c) Forty percent of the students failed. Find the pass mark. [1]

13 [P2 2014 Q 20]

In a biology class the number of seeds germinating over a period of 20 days were recorded and represented in the in the histogram to the right.

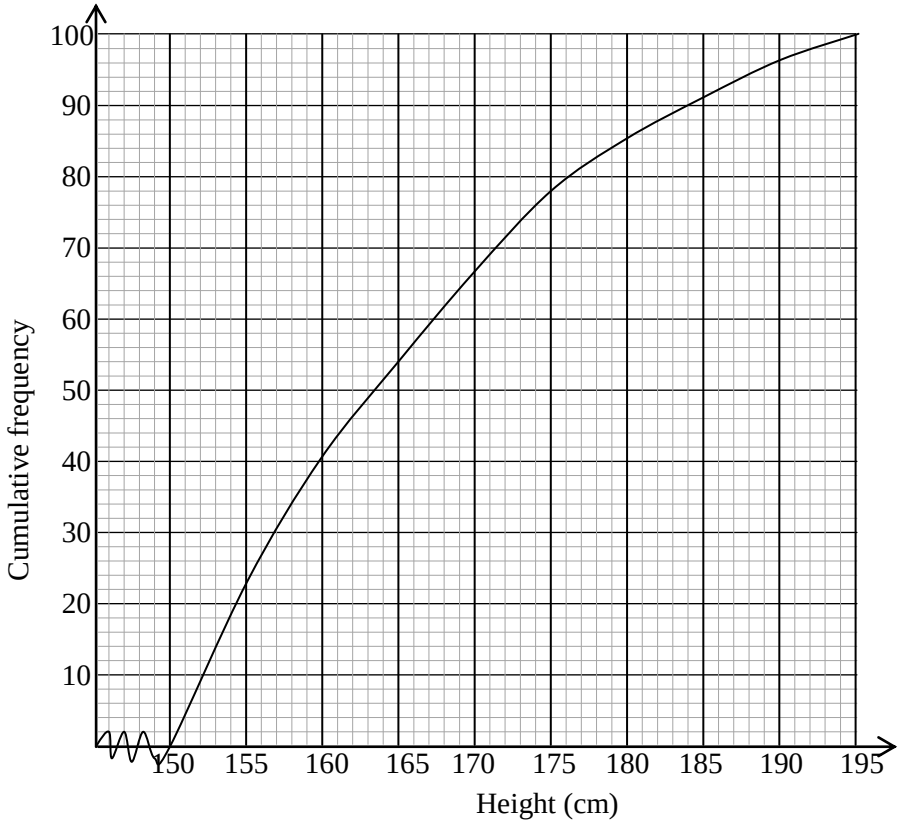
Use the histogram shown to complete the frequency table below.



Time in days	Number of seeds germinated
$0 < t \leqslant 5$	
$5 < t \leqslant 15$	
$15 < t \leqslant 20$	

14 [P4 NSSC 2014 Q 13]

The heights of 100 students were measured. The results are shown in the cumulative frequency curve and the cumulative frequency table shown below.



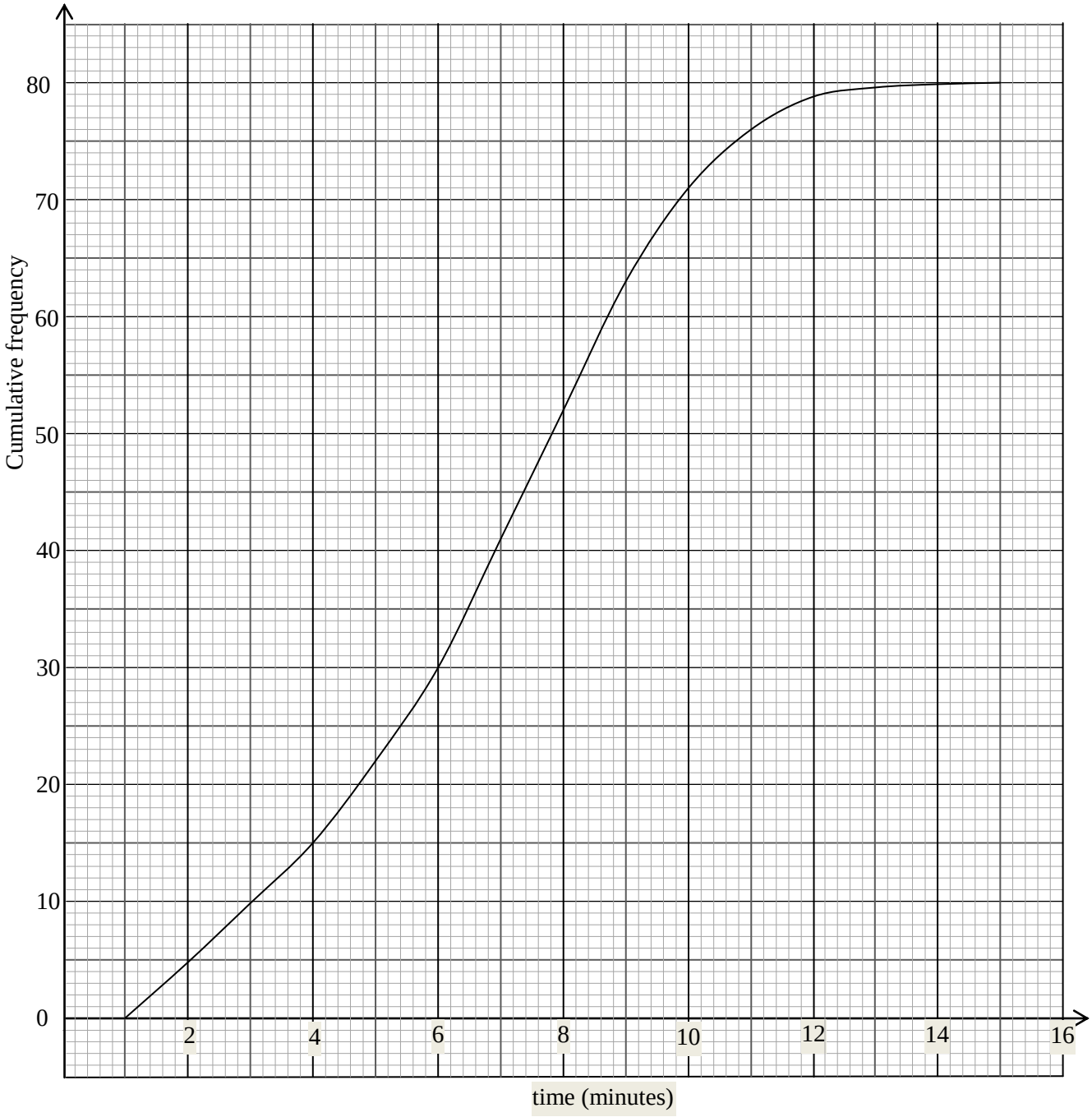
Height, h (cm)	$150 < h \leqslant 160$	$160 < h \leqslant 170$	$170 < h \leqslant 180$	$180 < h \leqslant 190$
Frequency	a	b	18	9

(a) Use the cumulative frequency curve to find a and b. [1]

(b) Calculate the mean height of the 100 students. [3]

15 [P2 NSSC 2015 Q 12]

The cumulative frequency curve drawn below shows the time taken (in minutes) for 80 soccer fans to leave the stadium after watching a soccer game.



(a) Estimate the number of people who took more than 10 minutes to leave the stadium. [2]

(b) Estimate the number of people who took between 3 and 8 minutes to leave the stadium. [2]

(c) Determine how long it took half the people to leave the stadium. Clearly show your working on the graph. [2]

16 [P4 NSSC 2015 Q 8]

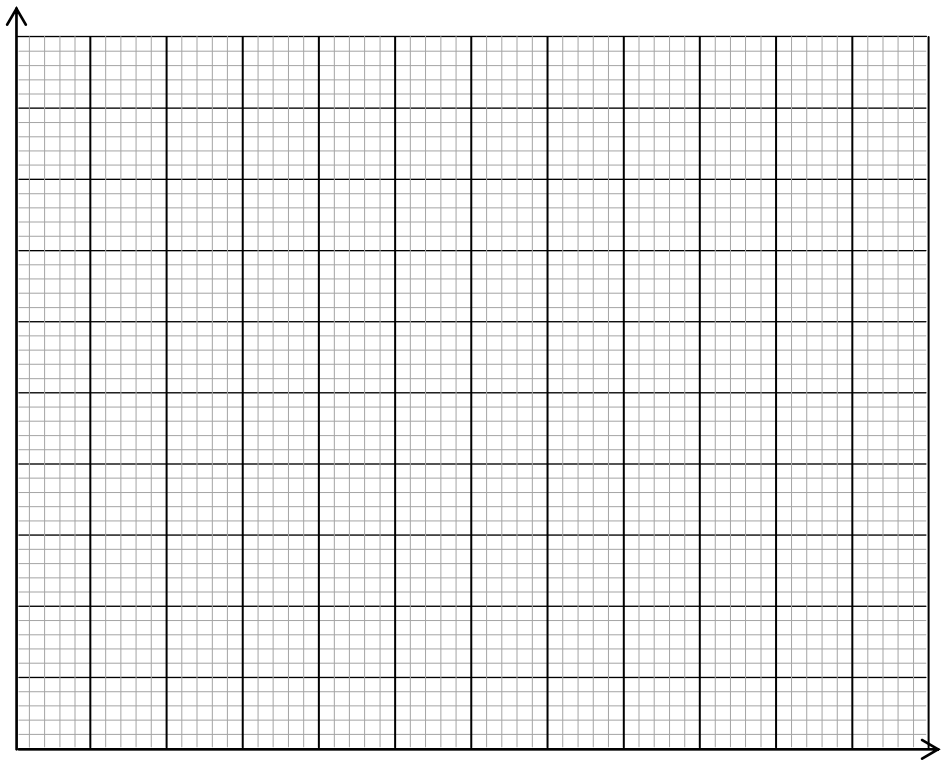
The table shows the distribution of the masses of 50 boys in a wrestling competition.

Mass (m) in kg	Frequency
$40 < m \leq 50$	20
$50 < m \leq 60$	15
$60 < m \leq 80$	5
$80 < m \leq 85$	10

(a) Calculate an estimate of the mean mass of the boys. Show all your working. [4]

(b) In which interval will the median mass fall? [1]

(c) Draw a histogram, on the grid below, to represent this distribution. Using a horizontal scale of 2 cm to represent 10 kg and a vertical scale of 2 cm for 0.5 units. [5]



(d) A boy is chosen at random. Find the probability that the mass lies in the range $60 < m \leq 80$. Give your answer as a simplified fraction. [1]

(e) Two boys are chosen at random. Find the probability that the mass of one boy is in the range $60 < m \leq 80$ and the mass of the other boy is in the range $80 < m \leq 85$. Give your answer as a simplified fraction. [2]

(f) Three boys are chosen randomly from the group of boys. Calculate the probability that all three are from the interval $50 < m \leq 60$. Give your answer as a simplified fraction . [2]

17 [P2 NSSC 2016 Q 8]

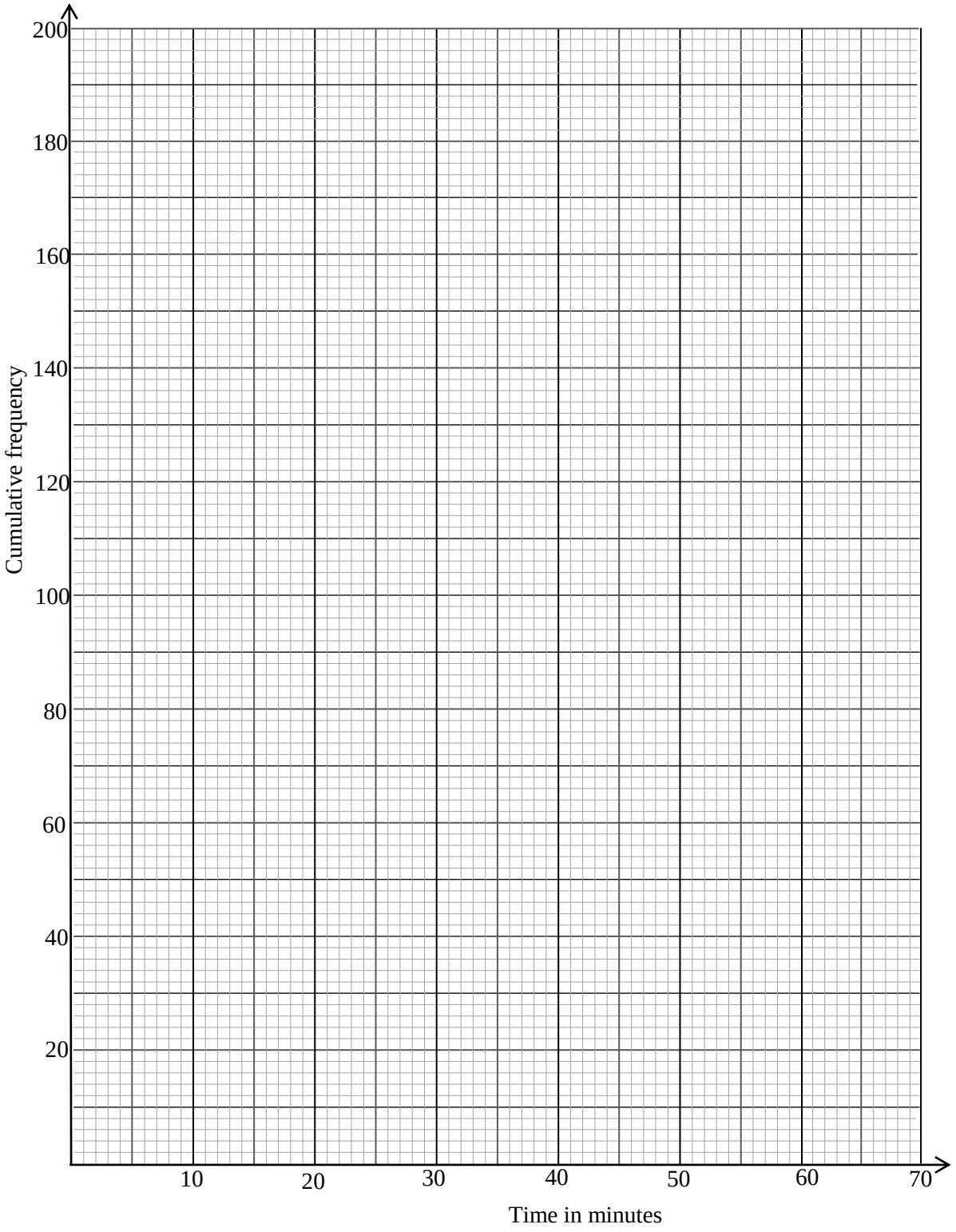
200 learners were asked how many minutes they spent on Facebook during a period of 70 minutes. The results are shown in the table below.

(a) Fill in the cumulative frequency table for the given data. [2]

Time (t) in minutes	Number of learners
$0 < t \leq 10$	8
$10 < t \leq 20$	12
$20 < t \leq 30$	34
$30 < t \leq 40$	46
$40 < t \leq 50$	42
$50 < t \leq 60$	38
$60 < t \leq 70$	20

Time in minutes	Cumulative Frequency
$t \leq 0$	0
$t \leq 10$	
$t \leq 20$	
$t \leq 30$	
$t \leq 40$	
$t \leq 50$	
$t \leq 60$	
$t \leq 70$	

(b) On the grid, draw the cumulative frequency curve for the given data. [3]



(c) Use the graph to find **(i)** the median [1]

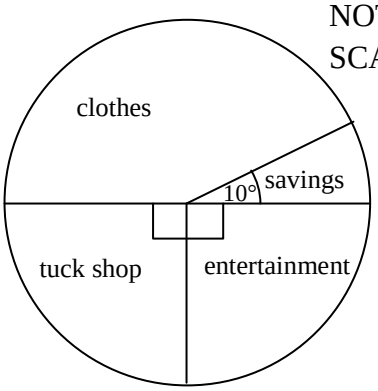
(ii) the lower quartile [1]

(iii) the interquartile range [2]

(iv) the number of learners spending more than 45 minutes on Facebook. [2]

18 [P2 NSSC 2016 Q 6]

Caroline receives N$180 pocket money from her parents per month.
She draws a pie chart to illustrate how she spends the money.
The angle representing her savings is 10°, entertainment and tuck shop spending are both 90° and the remaining sector represents clothes.



(a) Calculate the angle representing clothes. [1]

(b) Calculate the amount of pocket money she saves. [2]

(c) Calculate the percentage of her pocket money spent on savings and entertainment. [2]

19 [P4 NSSC Q4 2016]

60 girls in a Grade 12 class were asked their heights. The results are summarized below.

Height (h cm)	$130 < h \leq 150$	$150 < h \leq 155$	$155 < h \leq 160$	$160 < h \leq 165$	$165 < h \leq 180$
Frequency	3	7	20	25	5

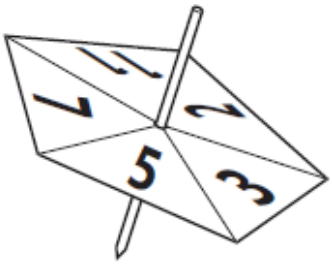
(a) Calculate an estimate of the mean height of the 60 girls. [4]

(b) Explain why the mean height is an estimate, although you made a calculation. [2]

Section 16 Probability

1 [P1 May June 2006 Q 21]

A fair five-sided spinner is numbered using the prime numbers 2, 3, 5, 7 and 11.



(a) In a game, players spin it twice and add the two numbers obtained.

(i) Complete the possibility diagram. [1]

+	2	3	5	7	11
2	4	5			
3					
5			10	12	
7			12		
11					

(ii) Find the probability that the total of the two numbers is **(a)** a prime number [1]

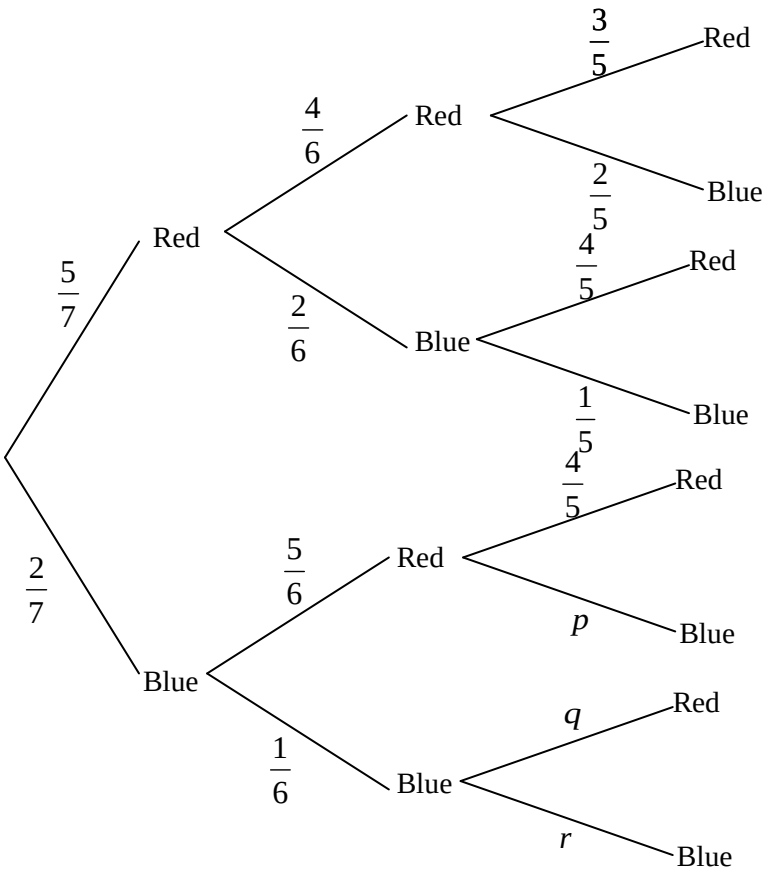
(b) a perfect square. [1]

(b) In another game, players spin it twice and multiply the two numbers obtained.
Without drawing another possibility diagram, write down the probability that this product is a prime number. [1]

2 [P2 May/June 2005 Q 5 (b)]

A bag contains 5 Red and 2 Blue beads. Chris took 3 beads, at random, and without replacing from the bag. The probability tree shows the possible outcomes and their probabilities.

1 st bead 2nd bead 3rd bead.



(a) Write down the values of p, q and r. [2]

(b) Expressing each answer as a fraction in its lowest terms, find the probability that

(i) three Red beads were taken, [1]

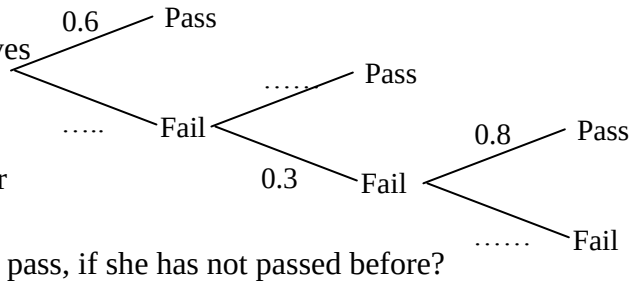
(ii) the first bead was Red, the second Blue and third Red. [1]

(iii) two of the beads were Red and one was Blue. [2]

3 [P2 NSSC 2007 Q 12]

The probability that a candidate will pass her driving license test at the first attempt is 60%.

After every attempt, her chance of passing improves by 10%.



(a) Complete the tree diagram → [2]

(b) Find the probability that this candidate fails her first two attempts but passes on the third. [2]

(c) On which attempt will this candidate definitely pass, if she has not passed before? [1]

4 [P4 NSSC 2011 Q 13]

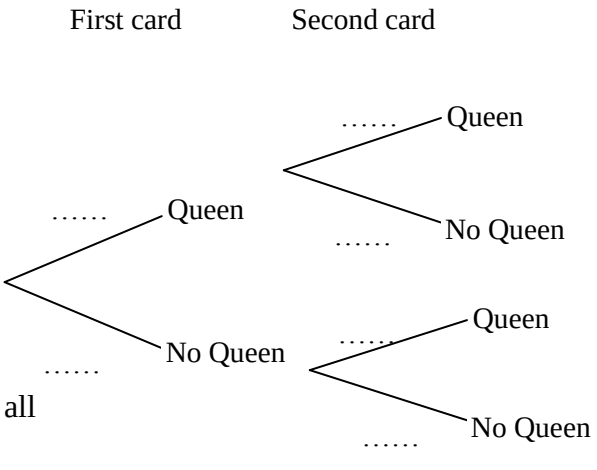
Anna and John play with a deck of ordinary playing cards. The deck contains 4 suites of 13 cards.

(a) Anna draws one card from the complete deck. What is the probability that Anna will draw:

(i) an ace [1]

(ii) a spade? [1]

(b) John draws a card from the complete deck. He then draws another card without putting the first card back.



(i) Complete the probability diagram to show the probability of drawing a queen from the deck of cards. [3]

(ii) Calculate the probability that he draws exactly one queen. [2]

(iii) John draws a third card without replacing the other two. Calculate the probability that all three cards he draws are queens. [2]

5 [P2 NSSC 2013 Q10]

Peter plants 12 rose trees. He knows that 4 trees will give red roses, 2 trees will give pink roses and 6 Trees will give white roses.

(a) What is the probability that the first rose tree to flower will give white roses? [1]

(b) By means of a tree diagram, show the probability of how two rose trees chosen at random will flower? Write the probability for each colour of rose on each branch. [5]

(c) What is the probability, that of the first two rose trees to flower,

(i) both will give pink roses, [1]

(ii) one will give white roses and the other red roses? [2]

6 [P2 NSSC 2013 Q14]

Cards numbered from 1 to 16 are placed in a box and shaken. A card is drawn at random from the box. The number on the card is noted. Calculate, giving your answer in its simplest form, the probability of drawing a card with a number which is

(a) a factor of 15 and an odd number. [2]

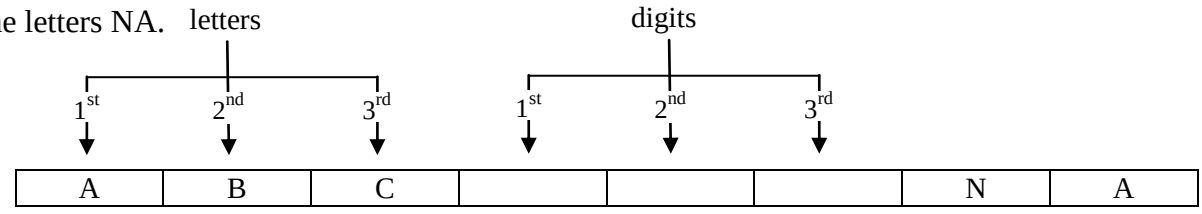
(b) a factor of 15 or an odd number. [2]

(c) a multiple of 2 or an odd number. [2]

(d) a multiple of 2 and an odd number. [1]

7 [P2 NSSC 2014 Q17]

Personalised vehicle registration numbers consist of three letters from the alphabet, three natural numbers and the letters NA.



(a) List the possible outcomes for the first digit. [1]

(b) For the given conditions, determine the following probabilities

(i) *P*(for the first digit to be a prime number) [1]

(ii) *P*(for the first digit to be a square number) [1]

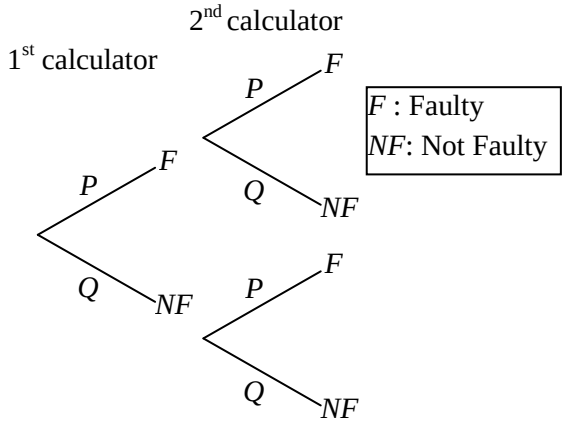
(iii) *P*(for the second digit not to be less or equal to 6) [1]

(c) Choose your three digits as follows and write down your registration number

- The first digit is the only even prime number
- The second digit is the cube root of 1
- The third digit is the square of 3 [3]

8 [P4 NSSC 2014 Q10]

A batch of calculators is tested by the manufacturer.
Each time a calculator is tested at random the probability that it is faulty (*F*) is 0.05. The tree diagram to the right shows the results of the tests.



(a) Write down the values of *P* and *Q*. [2]

(b) Two calculators are chosen at random.
Calculate the probability that:

(i) both are faulty, [2]

(ii) exactly one is faulty. [2]

(c) The whole batch of calculators will be rejected id the first two are faulty as well as a third calculator chosen randomly. Calculate the probability that the whole batch will be rejected. [3]

9. [P2 NSSC 2015 Q4]

Jane spins an unbiased 4 sided spinner twice. The table shows the possible outcomes.

second spin \ first spin	side	1	2	3	4
	1	1 and 1	1 and 2	1 and 3	1 and 4
	2	2 and 1	2 and 2	2 and 3	2 and 4
	3	3 and 1	3 and 2	3 and 3	3 and 4
	4	4 and 1	4 and 2	4 and 3	4 and 4

Write your answer as a fraction in their simplest form.

(a) Find the probability that the numbers shown on both spins are different. [2]

(b) Find the probability that a prime number appears on both spins. [2]

(c) Find the probability that a perfect square appears on both spins. [1]

(d) Find the probability that the product of the two numbers is less than the sum of the two numbers.
Show your working. [3]

10 [P4 NSSC 2016 Q3]

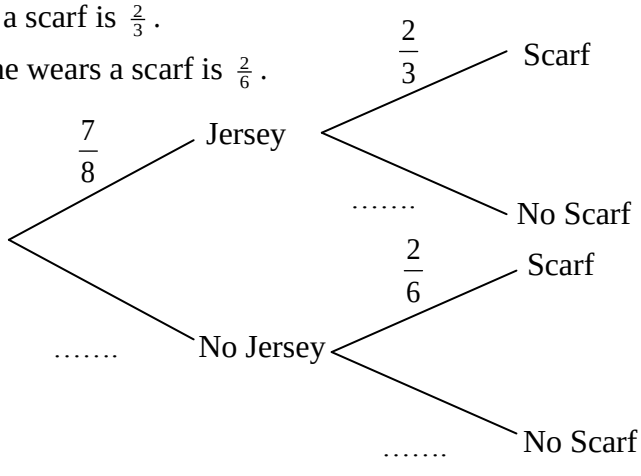
In this question, give all your answers as fractions.

When Johannes goes to school in winter, the probability that he wears a jersey under his blazer is $\frac{7}{8}$.

If he wears a jersey the probability that he wears a scarf is $\frac{2}{3}$.

If he does not wear a jersey, the probability that he wears a scarf is $\frac{2}{6}$.

(a) Complete the diagram.



[3]

(b) Find the probability that Johannes

(i) does not wear a jersey and does not wear a scarf, [2]

(ii) does not wear a jersey, but wears a scarf, [2]

(iii) wears a jersey or a scarf, but not both. [2]

(c) If Johannes wears a jersey and a scarf, the probability that he wears gloves is $\frac{9}{10}$.

Calculate the probability that Johannes does **not** wear any of the 3 items (no jersey, no scarf and no gloves.) [3]

Section 17 Bearings and angles

1 [P1 May June 2006 Q 22]

Draw a map using a scale of 1 cm to 5 m. Choose point *A* to the left of you paper. North is facing upwards.

(a) The point *B* is 70 m due east of *A*, draw the line representing *AB*. [3]

(b) The point *C* is north of *AB* and equidistant from *A* and *B*. Angle *BAC* = 40º.

(i) By drawing appropriate lines**,** find and label point *C*. [1]

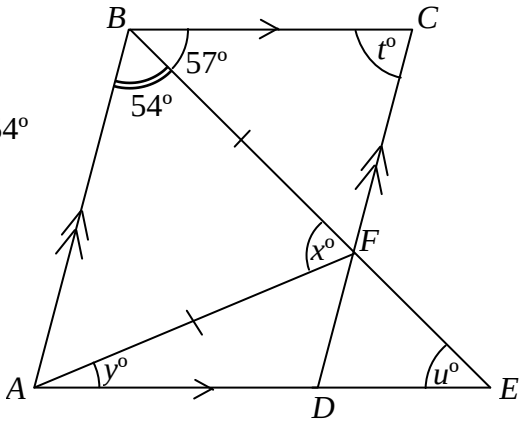
(ii) Find the actual distance *AC*. [1]

(iii) State the size of reflex angle *BAC*. [1]

2 [P2 May June 2005 Q 3 (a)]

In the diagram, *ABCD* is a parallelogram.

ADE and *BFE* are straight lines, *AF = BF;* ∠*ABF* = 54º and ∠*CBF* = 57º.



Find the value of

(a) *t* [1]

(b) *u* [1]

(c) *x* [1]

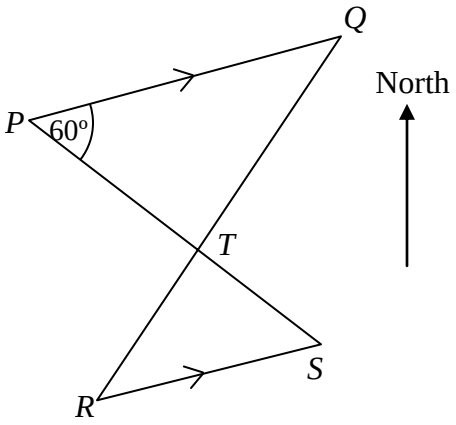
(d) *y* [1]

3 [P2 Oct/Nov 2011 Q 3]

P, *Q*, *R* and *S* are four points on level ground.

PQ is parallel to *RS* and angle *QPS* = 60º.

PS and *RQ* intersect at *T*.



(a) Write down the value of ∠ *PSR*.

Give reasons for your answer. [1]

(b) The bearing of *Q* from *P* is 070º.

Find the bearing of

(i) *S* from *P* [1]

(ii) *P* from *S* [1]

(iii) *R* from *S* [1]

(c) **(i)** Explain why triangle *PQT* and *RST* are similar. [1]

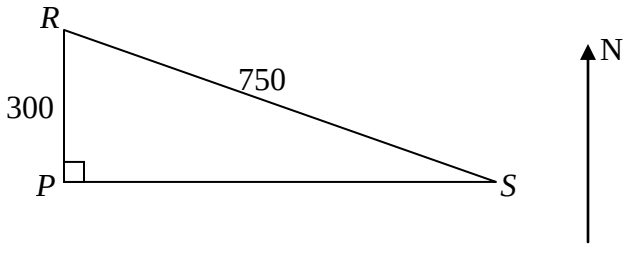
(ii) Given that *PT* = 54 m; *TS* = 36 m and *RQ* = 85 m, find *TQ*. [3]

4 [P2 Oct/Nov 2007 Q 1 (b)]

The diagram shows three points at sea, *R*, *P* and *S*.

R is due north of *P* and *S* is due east of *P*.

RP = 300 m and *RS* = 750 m.



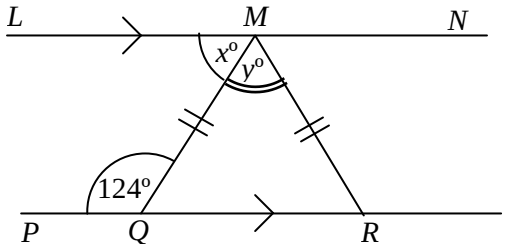
(a) A boat sailed at a constant speed of 5 km/h from *R* to *S*. it was at *R* at 22 56.
Find the time it reached *S*. [3]

(b) Calculate the bearing from *S* to *R*. [3]

5 [P2 Oct/Nov2007 Q 3]

In the diagram, *LMN* is parallel to *PQR*.
Angle *PQM* = 124º and *MQ* = *MR*.

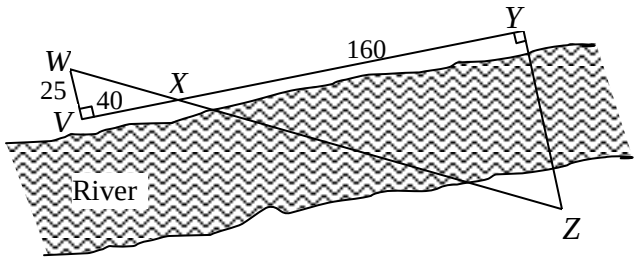
(a) Find **(i)** *x* **(ii)** *y* [1] [1]



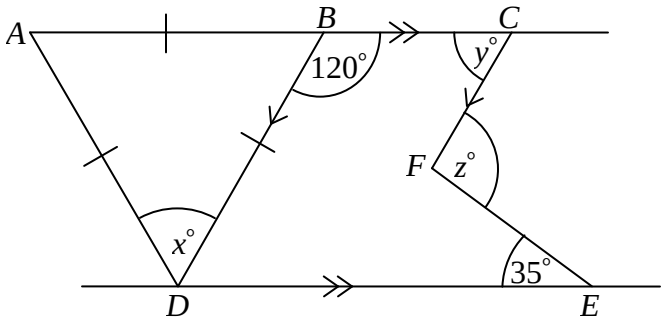
(b) In a surveying exercise to find the distance between the points *Y* and *Z* on opposite banks of a river, angles and lengths were measured. *WXZ* and *VXY* are straight lines.
Angle *WVX* = angle *XYZ* = 90º

(i) Show that triangles *VWX* and triangle *YZX* are similar.

(ii) *VW* = 25 m, *VX* = 40 m and *XY* = 160 m. Calculate the distance YZ.



6 [P2 NCCS 2015 Q 9]



In the diagram the straight line *ABC* is parallel to line *DE* and line *BD* is parallel to line *CF*. *AD* = *BD* = *AB*, angle *DBC* = 120° and angle *FED* = 35°.

(a) Calculate the angles **(i)** *x* [1]

(ii) *y* [1]

(iii) *z* [1]

(b) What kind of triangle is triangle *ABD*? [1]

Section 18 Factorization; simplification of expressions and completion of square.

1 [P1 May June 2006 Q 23]

(a) Simplify**: (i)** $x(3x + 2) - (2x + 4) =$ **(ii)** $\frac{ax^2 - x^2}{ax - x}$ [1]; [2]

(b) Factorize completely: $7x^2 - 63$ [2]

2 [P1 Oct/Nov 2011 Q 23 (a)]

Factorize: $9x^2 - 1$ [2]

3 [P1 May June 2003 Q 5 (a)]

Factorize: $x^2 - 7x + 12$ [2]

4 [P1 May June 2003 Q 20]

(a) Expand and simplify: $(x - 1)(x^2 + x + 1)$ [2]

(b) Factorise: $ax - bx - 3ay + 3by$ [2]

5 [P2 May/June 2005 Q 1]

(a) Remove the brackets and simplify: **(i)** $4(3 - 2p) - 3(1 - p)$ [1]

(ii) $(3q - r)(q + 2r)$ [2]

(b) Factorize completely: $18t^2 - 2$ [2]

6 [P2 Oct/Nov 2011 Q 2 (c) & (d)]

(a) Express as a single fraction: $\frac{5}{p-2} - \frac{4}{2p+3}$ [3]

(b) Simplify: $\frac{q^2 - 1}{2q^2 - 3q + 1}$ [3]

7 [P2 NSSC 2009 Q 21]

Write $x^2 + 6x + 1$ in the form of $(x + p)^2 + q$. [2]

8 [P2 NSSC 2007 Q 11]

(a) Expand $(x - 2)^2$ **(b)** Write $x^2 - 4x - 3$ in the form of $(x + p)^2 + q$. each [2]

9 [P2 NSSC 2013 Q 7]

Expand and simplify $3(x - 2)^2 - (3x - 2)$. [3]

10 [P2 NSSC 2014 Q 7]

What must be added to $x^2 - x + 4$ to make it equal to $(x + 2)^2$? [3]

11 [P4 NSSC 2014 Q 5ab]

(a) Simplify **(i)** $8x - 4(x + 3)$ [2]

(ii) $\frac{a^2 - 3a}{a^2 + 4a - 21}$ [4]

(b) Factorize **(i)** $2a^2 + 2ab - b^2 - ab$, [2]

(ii) $6x^2 - x - 1$ [2]

12[P2 NSSC 2015 Q 10]

Simplify

(a) $2x - 3(x + 2)$ **(b)** $(2x + 3)(x - 5)$ both [2]

13[P4 NSSC 2015 Q 3]

(a) Simplify **(i)** $\frac{18ab^3}{15bc}$ **(ii)** $\frac{x^2 + x - 12}{x^2 - 16}$ **(iii)** $\frac{2^{x-1} \times 8^{x+1}}{4^{2(x-1)}}$ [2] [4] [3]

(b) Subtract $x^3 - 5x^2 - 6x - 2$ from $x^3 + 4x^2 - 9x - 36$ [2]

(c) It is given that $x^2 + 4y^2 = 8$ and $x = 2 - 2y$

(i) Show that if the equations are solved simultaneously, it leads to the equation $2y^2 - 2y - 1 = 0$ [4]

(ii) Solve $2y^2 - 2y - 1 = 0$ by completing the square. [4]

(iii) Write down the coordinates of the points of intersection of $x^2 + 4y^2 = 8$ and $x = 2 - 2y$. [2]

14 [P2 NSSC Q 10]

Express $2x^2 + 3x - 2$ in the form $a(x + p)^2 + q$. Determine the values of a, p and q. [3]

15 [P4 NSSC Q6ab]

(a) Factorise the following completely:

(i) $2a - 3b - 4xa + 6xb$, [2]

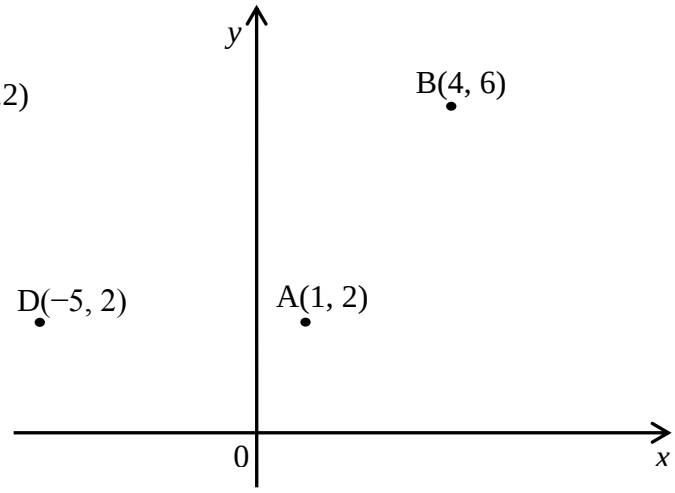
(ii) $x^2y^2 + x^2 + y^2 + 1$. [2]

(b) Simplify the expression $\frac{2}{x^2 - 9} - \frac{5}{x - 3}$. [4]

Section 19 Coordinate geometry

1 [P1 May June 2006 Q 25]

The diagram shows the points $A(1, 2)$, $B(4, 6)$ and $D(-5.2)$



(a) Find the coordinates of the midpoints of AB

(b) Calculate the length of the line AB.

(c) Calculate the gradient of the line AB

(d) Find the equation of the line AB.

(e) The triangle ABC has line of symmetry $x = 4$. Find the coordinates of C.

(f) Find the value of cos angle DAB

2 [P2 Oct/Nov 2007 Q 11 (a)]

P is the point (2, 9) and Q is the point (4, 6) Find:

(a) the length of PQ, [2]

(b) the equation of line PQ. [2]

3 [P4 NSSC 2011 Q 9]

$ABCD$ is a parallelogram, labeled anticlockwise, such that A and C have the following coordinates: $A(-1, 5)$ and $C(5, 1)$.

(a) Find the coordinates of the mid-point of AC. [2]

(b) Given that BD is parallel to $y = 2 - 5x$, find the equation of BD. [2]

(c) BC is perpendicular to AC. Find the equation of BC. [3]

(d) Show that B has coordinates (3, –2) [2]

4 [P4 NSSC 2009 Q 8]

The points A, B, C and D have the following coordinates(–4, 5), (2, 1), (1, –4) and (–5, 0) respectively. Find

(a) the coordinates of the midpoint AB. [1]

(b) the equation of the line L_1 which passes through the point C and is parallel to the line AB. [3]

(c) the equation of the line L_2 which passes through the point D and is perpendicular to the line AB. [2]

(d) the coordinates of the point of intersection of the lines L_1 and L_2. [4]

5 [P4 NSSC 2013 Q 6]

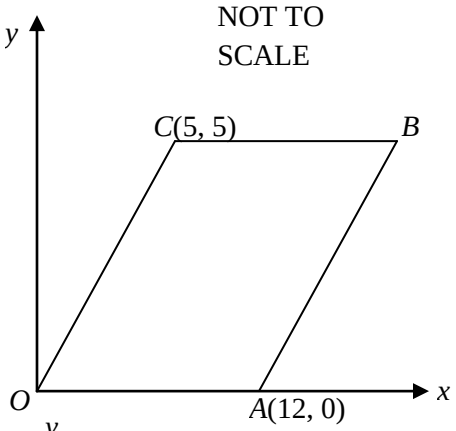
OABC is a parallelogram. The coordinates of *A* and *C* are (12, 0) and (5, 5) respectively.

(a) Calculate the length of *OC*. [2]

(b) Find the gradient of *OC*. [2]

(c) Find the equation of line *AB*. [3]

(d) Hence determine the coordinates of point *B*. [4]



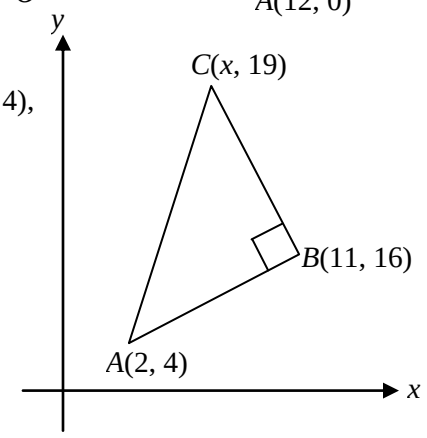
6 [P2 NSSC 2013 Q 13]

The diagram shows a right-angled triangle *ABC* with line *CB* perpendicular to line *AB*. Triangle *ABC* has vertices *A*(2, 4), *B*(11, 16) and *C*(*x*, 19) in the Cartesian plane.

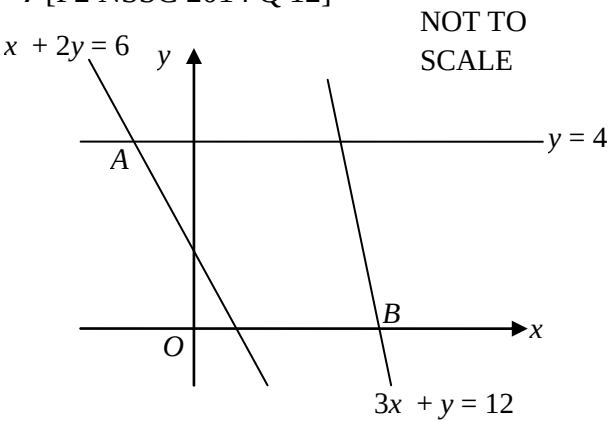
(a) Determine the gradient of *AB*. [2]

(b) Hence, write down the gradient of *BC*. [2]

(c) Determine the value of *x*. [2]



7 [P2 NSSC 2014 Q 12]



(a) The line $y = 4$ meets the line $x + 2y = 6$ at point *A*. Find the co-ordinates of *A*. [1]

(b) The line $3x + y = 12$ meets the *x* axis at point *B*. Find the co-ordinates of *B*. [1]

(c) **(i)** Find the co-ordinates of the midpoint, *M*, of the line joining *A* to *B*.

(ii) Find the equation of the line through *M* perpendicular to $3x + y = 9$. [3]

8 [P4 NSSC 2014 Q 12]

Line *AB* passes through the point (9, −4) and has a gradient of $\frac{1}{3}$.

(a) Find the equation of the line *AB* in the form $ax + bx + c = 0$. [3]

(b) Another line *CD* passes through the origin and has a gradient of −2. These two lines meet at point *E*. Find the coordinates of point *E*. [4]

9 [P2 NSSC 2016 Q15]

It is given that points *A* and *B* have coordinates *A*(2, −3) and *B*(−4, −5).

(a) Calculate the coordinates of the point *M*, the midpoint of *AB*. [2]

(b) Calculate the distance between *A* and *B*. [2]

(c) Using the coordinates of *M* from part **(a)**, calculate the equation of the straight line passing through *M* which is perpendicular to *AB*. [4]

Section 20 Ratio & Direct and inverse proportion

1 [P1 May June 2006 Q 5 (b)]

Potatoes cost 75 cents per kilogram. John paid $1.20 for a bag of potatoes.

How many kilograms did he buy? [1]

2 [P1 Oct/Nov 2011 Q 2 (a)]

Ali and Ben share \$30 such that Ali's share : Ben's share = 3 : 2. Calculate Ali's share. [1]

3 [P2 May/June 2005 Q 2 (a)]

Two varieties of tea, 'High Blend' and 'Normal Blend', are made by mixing Grade A leaves and Grade B leaves.

(a) In High Blend, the ratio of the masses of Grade A leaves to Grade B leaves is 3 : 2.
Find the mass of Grade A leaves in making 250 g of High Blend. [1]

(b) 1 kg of Normal Blend is made by using 450 g of Grade A leaves.
Find in its **simplest form** the ratio of the masses of grade A to grade B leaves in Normal Blend. [2]

(c) 250 g of High Blend is mixed with 1 kg of Normal Blend.
Calculate the percentage of the mass of the mixture that consists of Grade A leaves. [2]

4 [P2 Oct/Nov 2011 Q 6 (a)]

Ada and Bill own a company. In 2008 Ada invested \$22 500 in the company and Bill invested \$37500.

(a) Express 22500 : 37500 in the form $m : n$, where m and n are the smallest possible integers. [1]

(b) The profit made by the company in 2008 was shared in the ratio of the amounts invested.
Given that Ada's share in the profit is \$3 600, calculate the total profit made by the company. [1]

(c) Ada's investment in 2008 is 12½ % more than the amount she invested in 2007.
Calculate the amount that Ada invested in 2007. [2]

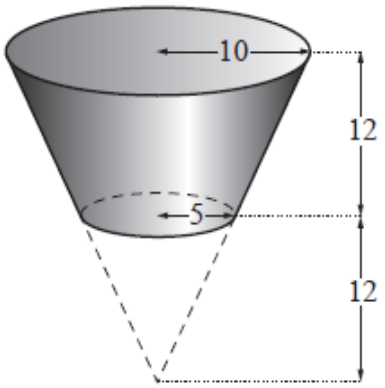
5 [P2 Oct/Nov 2007 Q 7]

(a) Compost for growing plants consists of 3 parts of soil to 2 parts of sand to 1 part of peat.

(i) Calculate the number of litres of sand in a 75 litre bag of compost. [2]

(ii) Compost is sold in 5 litre, 25 litre and 75 litre bags costing \$2, \$8.75 and \$27 respectively.
Showing your working clearly, state which bag represents the best value for money. [2]

(b) [The volume of a cone = $\frac{1}{3}$ × base area × height]



The diagram shows a plant pot.
The open end of the plant pot is a circle with radius 10 cm.
The closed end is a circle of radius 5 cm.
The height of the plant pot is 12 cm.
The plant pot is part of a righ circular cone of height 24 cm.

(i) Calculate the volume of the plant pot <u>in litres.</u> [4]

(ii) How many of these plant pots can be filled completely filled from a 75 litre bag of compost? [2]

(iii) A smaller plant pot is geometrically similar to the orginal plant pot. The open top end of this smaller pot has a radius of 5 cm.
How many of these pots can be filled from a 75 litre bag of compost? [2]

6 [P4 NSSC 2015 Q 1(a)-(c)]

In 2013, Namfish, a fishing company, exported fish to Spain at a constant ratio of hake : sardines : snoek as 7 : 3 : 5 respectively.

The total mass of fish exported to Spain in 2013 was 2250 tonnes.

(a) What fraction of the exported fish was snoek? Give your answer in its simplest form. [1]

(b) Calculate the mass of sardines that were exported, giving your answers in kilograms. [2]

(c) In April 2013 Namfish exported 8 tonnes of sardines. Determine the mass of hake that was exported to Spain in April 2013. Give your answer to the nearest tonne. [3]

Section 21 Order of numbers; number properties; fractions and calculator skills

1 [P1 Oct/Nov 2011 2 (b)]

Write the following times in order of size, starting with the smallest.

6500 seconds 110 minutes $1\frac{3}{4}$ hours [1]

2 [P1 May June 2003 Q 6]

(a) Express 99 as the product of its prime factors. [1]

(b) Find the smallest possible integer value of n for which $99n$ is a multiple of 24. [1]

3 [P2 May/June 2005 Q 6]

Read these instructions

A Choose two **different** digits from 1, 2, 3, 4, 5, 6, 7, 8, and 9

B Write down the larger two-digit number which can be formed from the chosen digits.

C Write down the smaller two-digit number which can be formed from the chosen digits.

D Subtract the smaller number from the larger and note the result.

Example: Choose 2 and 8 $\rightarrow$ larger number is 82 $\rightarrow$ smaller number 28 $\rightarrow$ difference 82 – 28 = 54 (result)

(a) The digits 3 and 7 are choosen, follow instructions and find the result. [1]

(b) Choose three other different pairs of digits, follow the instructions to find the result in each case. [1]

(c) What do you notice about all these results? [1]

(d) The digits x and y are choosen, with $x > y$. Find expressions in terms of x and y, for the value of

(i) the larger number [1]

(ii) the result [2]

4 [P2 NSSC 2008 Q 2]

Work out the value of $\dfrac{\sqrt{3}+6\times(-2)}{\sqrt[3]{3}\times 2}$

5 [P2 NSSC 2008 Q 4]

Write the following values in descending order. $\frac{1}{8}$ 12.56% $1\frac{63}{250}$ 0.1251

6 [P2 NSSC 2011 Q 5]

$\sqrt{\frac{9}{4}}$, $\sqrt[3]{729}$, $\sqrt{\frac{9}{2}}$, $\sqrt{9}$ write down all the numbers from the list which are rational.

7 [P2 NSSC 2009 Q 3]

Consider these nine numbers: 1 $\frac{1}{6}$ $\sqrt{2}$ π 5 9 17 0.4 121

Write down **(a)** the prime numbers **(b)** the square numbers **(c)** the irrational numbers

8 [P2 NSSC 2013 Q ?]

Calculate the value of $\frac{1}{3}\sqrt{\frac{1}{3}+\frac{1}{3}}\ \sqrt{\frac{1}{3}}$

(a) Write down full calculator display, [1]

(b) Write your answer correct to 4 significant figures. [1]

9 [P2 NSSC 2014 Q 6]

There are 135 Grade 12 students in Ompo SS. Each student studies English as a first language, together with one of the following languages: French; Afrikaans or German.
One third study French, three fifths study Afrikaans and the rest study German.
How many students study German? [2]

10 [P4 NSSC 2014 Q 61

(a) 2, 0.2, 18, $\frac{3}{4}$, 8, –2 From this list of numbers select one of the following:

(i) A factor of 12 [1]

(ii) A multiple of 6 [1]

(iii) A cube number [1]

(iv) A prime number [1]

(b) Insert any of the following: >; < or =, to complete the statements below

(i) 0.2 ….. $\frac{3}{4}$ [1]

(ii) –2 …… 0.2 [1]

(c) Solve the following, giving your answer to 3 significant figures.

(i) $\sqrt{14}$ [1]

(ii) $\sqrt[3]{14}$ [1]

11 [P2 NSSC 2016 Q2]

From the list of numbers: 165 166 167 168 169 170 ,find

(a) A prime number **(b)** a square number

(c) a multiple of 6 **(d)** the product of 15 and 11. [1] each

12 [P2 NSSC 2016 Q 4]

Write the following in descending order of size (largest first) cos 80° tan 275° sin 122° sin 195 [2]

13 [P4 NSSC 2016 Q 1(a)]

0.3, $\sqrt{5}$, 2, 8, −4, −½, 9 From the list select one of the following numbers

(i) an irrational number **(ii)** a negative number **(iii)** a cubic number

(iv) a prime number **(v)** a positive rational number. [1] each.

Section 22 Indices

1 [P1 Oct/Nov 2011 Q 7]

(a) Evaluate $4^0 - 4^{-2}$ **(b)** Simplify $(2x^2)^3$

2 [P1 May June 2003 Q 7]

(a) It is given that $5^{-2} \times 5^{k} = 1$. Write down the value of *k*. [1]

(b) It is given that $\sqrt[3]{7} = 7^{m}$. Write down the value of *m*. [1]

3 [P2 NSSC 2011 Q 15]

Simplify the following expression and write your answer without indices $\dfrac{2^{n+3} \times 3^{n+3}}{6^{n+1}}$ [4]

4 [P2 NSSC 2013 Q 11]

Solve the equation $x^{\frac{2}{3}} = 16$. Show all your working. [3]

5 [P2 NSSC 2014 Q 5]

Simplify **(a)** $\left(\dfrac{x^4}{16}\right)^{0.5}$

(b) $3^2 y^{-3} \div 2^3 y^{-2}$

6 [P4 NSSC 2014 Q 11a]

Solve $4^{x+1} = 18$

7 [P2 NSSC 2016 Q 3]

Calculate $\left(\dfrac{3^2}{2^2}\right)^{-1}$ **(a)** as a fraction **(b)** as a decimal, correct to 1 significant [2] [1]

Section 23 Sequences

1 [P1 Oct/Nov 2011 Q 8]

The first four terms of a sequence are 55, 53, 49, 41. The *n*th term of this sequence is $57 - 2^n$. [1]

(a) Calculate the fifth term.

(b) Write down the *n*th term of the sequence 56 55 52 45. [2]

2 [P2 NSSC 2008 Q 20]

In an arithmetic sequence the third term is 11 and the twelfth term is –7.

(a) Find the values of the first term, *a*, and the common difference, *d*. [4]

(b) Calculate the sum of the first 24 terms. [3]

3 [P4 NSSC 2007 Q 4]

(a) Keshia receives 50c pocket money in week 1. Each week, for the next 17 weeks, her pocket money is N$ 3 more than it is the week before.

(i) Write down the amount of pocket money she receives in Week 2. [1]

(ii) Calculate the amount of pocket money she receives in Week 8. [2]

(iii) Calculate the amount of pocket money that Keshia received in the eight weeks. [2]

(b) Ben also receives 50c pocket money in Week 1. Each week, for the next 7 weeks his pocket money is double **what** he receives the week before.

(i) Find the amount of money he receives in Week 1, Week 2 and Week 3. [2]

(ii) State whether the three values in part **(b) (i)** form an arithmetic or a geometric sequence. Give reasons for your answer. [1]

(c) Calculate the difference between the amount of pocket money that Keshia and Ben receive in week 8.[3]

4 [P4 NSSC 2009 Q 3]

Emily and her brother, Tom wants to save for a holiday at the end of the year.

(a) Emily decides to start with N$50 in the first month. For the following months she saves N$10 more than the previous month.

(i) Write down the amount she has to save in the third month. [1]

(ii) Calculate the amount she has to save in the 7^{th} month. [2]

(iii) Calculate the total amount Emily will have available after 12 months. [2]

(b) Tom decides to start with N$5 in the first month. For the following months he saves double The amount of the previous month.

(i) Find the amount Tom has to save in the 2^{nd} ,3^{rd} and 4^{th} months. [3]

(ii) Calculate the total amount Tom will have available after 12 months. [2]

5 [P2 NSSC 2011 Q 22]

The first four terms of a sequence are: 3, 10, 21, 36

The *n*th term of this sequence is $an^2 + bn$. Find the values of *a* and b. [5]

6 [P4 NSSC 2013 Q 3]

(a) (i) Write down the next 2 terms in the sequence $\frac{3}{4}, \frac{4}{7}, \frac{7}{11}, \frac{11}{18}$,.....,..... [2]

(ii) This sequence can be written in the form $\frac{a}{b}, \frac{b}{a+b}$, ...,.....

Write down the next two terms in terms of *a* and *b*. [2]

(c) A different sequence follows the pattern $\frac{1}{a}, \frac{2}{a+1}, \frac{3}{a+2}$ .....,.....

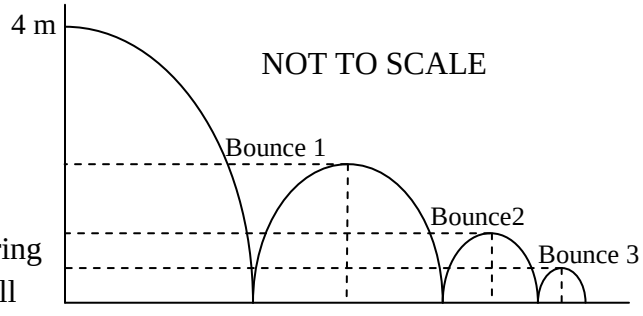
(i) Write the next two terms in the sequence. [2]

(ii) Write down the 50^{th} term of this sequence. [2]

(iii) Find the value of *a* if the 10^{th} term is equal to ½. [3]

7 [P2 NSSC 2013 Q 16]

A rubber ball is dropped from a height of 4 metres and bounces continuously as shown in the diagram.



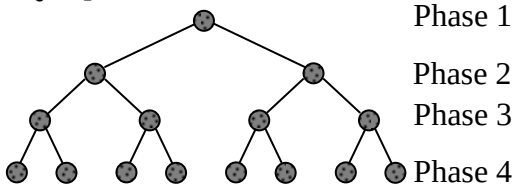
Each successive bounce reaches a height that is half the previous height.

(a) If the pattern of the maximum height reached during each bounce continues, what maximum height will the ball reach after the 6^{th} bounce? [2]

(b) Determine an algebraic expression for the maximum height reached after the n^{th} bounce. [3]

(c) After how many bounces will the ball reach a maximum height of $\frac{1}{512}$ metres? [3]

8 [P2 NSSC 2014 Q 13]



Cells keep on dividing in our bodies. Each cell forms 2 new cells. This process keeps on continuing and forms a sequence. The sketch above represents the cell division.

(a) How many cells will there be in phase 20? [3]

(b) Explain why this sequence is called a geometrical sequence. [1]

9 [P4 NSSC 2015 Q 9]

(a) A sequence of numbers is given by 25, 30, 35, ……..,300

(i) Find the number of terms in the sequence [3]

(ii) Find the sum of the sequence. [2]

(b) Determine the values of x for which the sequence log 3, $\log 3^3$, $\log 3^x$ is

(i) arithmetic **(ii)** geometric [4] [3]

10 [P2 NSSC Q16]

The terms 3, P, Q, 12.288, …… form part of a **geometric** progression.

Determine the values of P and Q. [4]

11 [P4 NSSC Q1(b)]

(i) Write down the missing information for sequences **A**, **B**, **C** and **D** in the table.

Term	**1**	**2**	**3**	**4**	**5**	n
Sequence **A**	7		15	19	23	$4n + 3$
Sequence **B**	1	8	27	64	125	
Sequence **C**	−5	0	5	10	15	
Sequence **D**	6	14		36	50	$n^2 + 5n$

[4]

(ii) Which term in sequence **D** is equal to 500? [2]

Section 24 Polygons

1 [P1 Oct/Nov 2011 Q 9]

Each interior angle of a regular polygon is p times each exterior angle.

Find an expression, **in terms of** p, for

(a) an exterior angle. [1]

(b) the number of sides of the polygon [1]

2 [P2 NSSC 2007 Q 15]

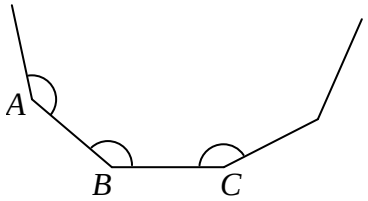
A, B and C are three vertices of a n-sided irregular polygon.

Angles A, B and C are each 150º.

The size of each of the remaining angles is 135º.

Calculate the number of sides of the polygon. [5]

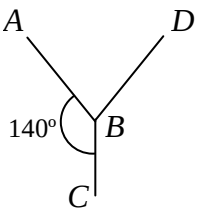
Show all your working.



3 [P2 NSSC 2009 Q 11]

Calculate the interior angle of a regular 10-sided polygon. [2]

4 [P1 May/June 2006 Q 12]



AB and *BC* are adjacent sides of a regular polygon, $\angle ABC = 140^o$

(a) Calculate the number of sides of the polygon [2]

(b) *CB* and *BD* are adjacent sides of a congruent regular polygon. Calculate $\angle ABD$ [1]

5 [P2 NSSC 2013 Q 12]

Kim, John and Sam work in a group to discuss the properties of certain polygons. After the discussion each one of them makes one statement.

For **(a)** to **(c)** write true or false for the given statement.

(a) Kim states that all equilateral triangles are congruent. [1]

(b) John states that a square is a special rhombus. [1]

(c) Sam states that a right-angled triangle cannot be isosceles. [1]

6 [P2 NSSC 2014 Q 3]

A heptagon has four angles which are each 120°. The other three angles are equal.

Calculate the size of one of these angles. [3]

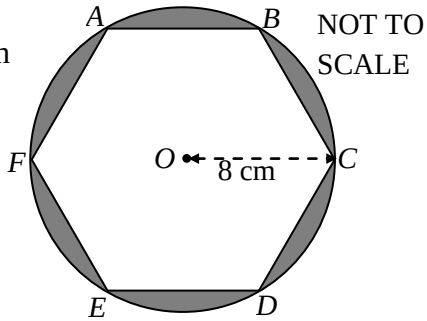
7 [P4 NSSC 2016 Q5]

(a) An irregular pentagon has angles $x°$, $3x°$, $2x°$, 104° and 85°.

(i) Calculate the smallest angle [3]

(ii) Hence, find the largest exterior angle of the pentagon. [1]

(b) The diagram shows a polygon *ABCDEF* inscribed by a circle with a radius of 8 cm, centre *O*.



(i) Write down the geometrical name of the polygon *ABCDEF*. [1]

(ii) Find the shaded area.

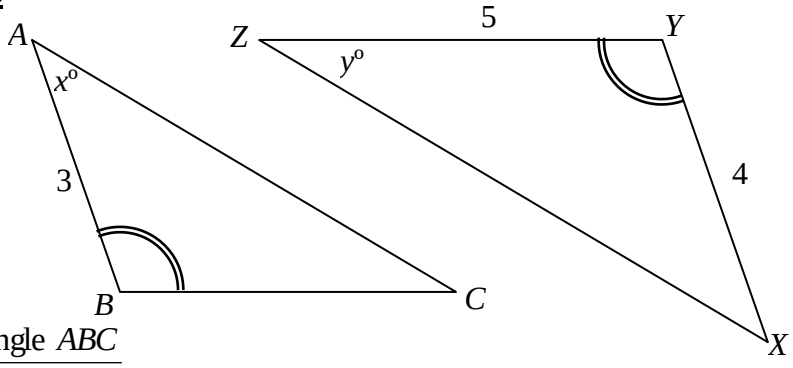
Section 25 Similar & congruent shapes

1 [P1 Oct/Nov 2011 Q 20]

The triangles *ABC* and *XYZ* are Similar and $\angle ABC = \angle XYZ$

$\angle BAC = x^o$, $\angle YZX = y^o$ where $x \neq y$

AB = 3 cm, *XY* = 4 cm and *YZ* = 5 cm.



(a) Express $\angle ABC$ in terms of *x* and *y*. [1]

(b) Find *BC*. [1]

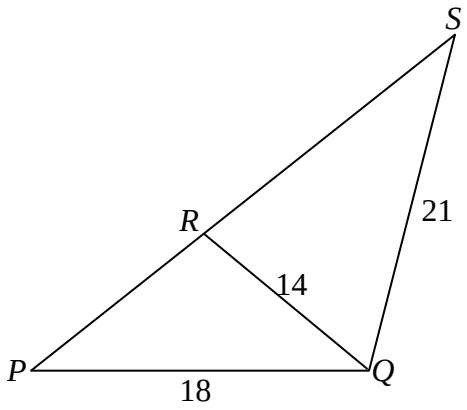
(c) Write down the value of $\frac{\text{area of triangle } ABC}{\text{area of triangle } XYZ}$ [1]

2 [P2 May/June 2005 Q 3 (c)]

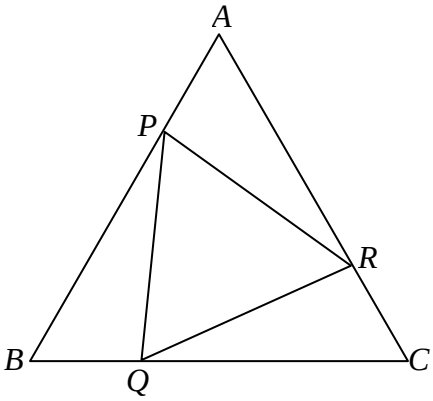
In the diagram, triangle *PQR* is similar to triangle *PSQ*.
$\angle PQR = \angle PSQ$, $PQ = 18$ cm, $QR = 14$ cm and $QS = 21$ cm
Calculate the length of

(a) *PR* [1]

(b) *RS* [2]



3 [P2 Oct/Nov 2011 Q 7 (a)]



In the diagram, *ABC* is an equilateral triangle.
The points *P*, *Q* and *R* lie on *AB*, *BC* and *CA* respectively, such that $AP = BQ = CR$

(a) Show that the triangles *APR*, *BQP* and *CRQ* are congruent. [3]

It is given that $AB = 5$ cm and $PQ = 4$ cm.

(b) Find $\dfrac{\text{area of triangle } PQR}{\text{area of triangle } ABC}$ [1]

(c) Find $\dfrac{\text{area of triangle } APR}{\text{area of triangle } ABC}$ [1]

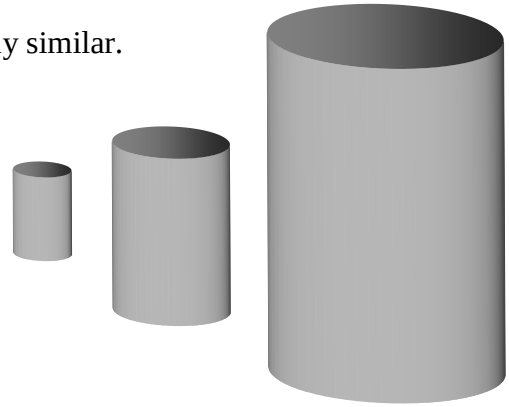
4 [P2 NSSC 2008 Q 13]

Two bronze statues are similar in shape. Their masses are 135 kg and 320 kg. The larger statue has a height of 1.6 m. Calculate the height of the smaller statue. [3]

5 [P2 NSSC 2011 Q 19]

The diagram shows three cylinders, which are mathematically similar.
The table below gives the information about the cylinders.

Size	**Height (cm)**	**Area of top of cylinder (cm^2)**	**Volume (cm^3)**
Small	6	**X**	400
Medium	12	500	
Large	18		**Y**

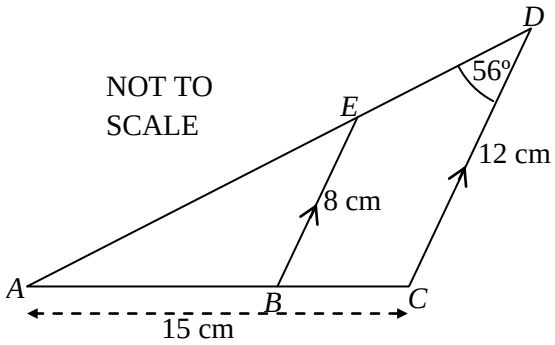


Calculate the missing entries **X** and **Y** [4]

6 [P2 NSSC 2013 Q 19]

In the diagram, *BE* is parallel to *CD*. $AC = 15$ cm,
$BE = 8$ cm and $CD = 12$ cm.
Angle $ADC = 56^\circ$

NOT TO SCALE



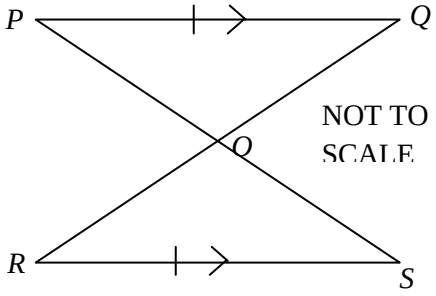
(a) Write down the size of angle *AEB* and give reasons for your answer. [2]

(b) Complete the following statement:
Triangle *ABE* is …….. to triangle *ACD*. [1]

(c) Calculate the length of *AB*. [2]

(d) The area of triangle *ABE* is 36 cm^2. Calculate the area of triangle *ACD*. [2]

7 [P2 NSSC 2015 Q 5]



The diagram shows two straight lines, *PQ* and *RS*, which are equal and parallel. The lines *PS* and *QR* **bisect** each other at the point *O*.

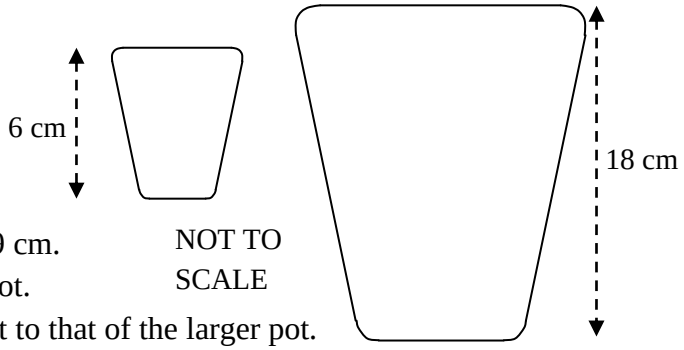
Explain why the triangle *POQ* and triangle *SRO* are congruent. [3]

8[P2 NSSC 2016 Q 7]

Two plant pots are geometrically **similar.**

The height of the smaller pot is 6 cm.

The height of the larger pot is 18 cm.



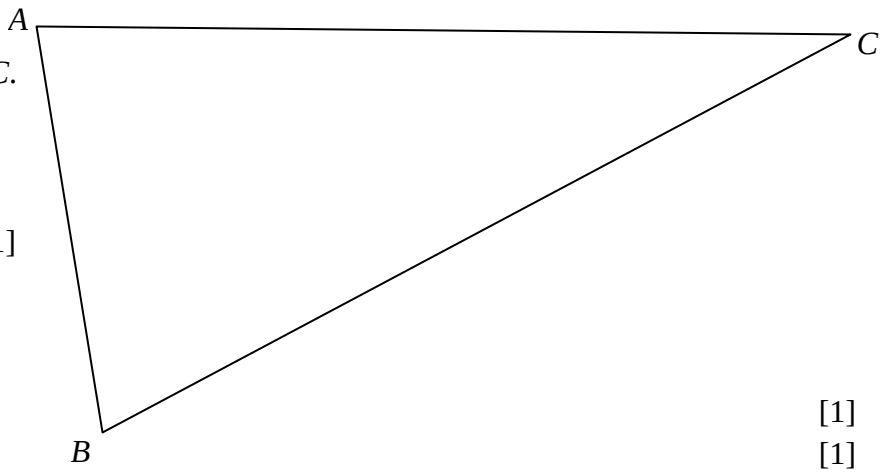
(a) The diameter of the base of the larger pot is 9 cm.
Find the diameter of the base of the smaller pot. [1]

(b) Find the ratio of the volume of the smaller pot to that of the larger pot.
Give your answer in the form 1 : *n*. [2]

Section 26 Constructions & locus

1 [P1 Oct/Nov 2011 Q 26]

The diagram below shows triangle *ABC*.



(a) The point *D* is on the opposite side of *AC* to *B*.
AD = 6 cm and *CD* = 8 cm.
Construct triangle *ADC*. [1]

(b) On the diagram construct the locus of points **inside** quadrilateral *ABCD* that are
(i) 2.5 cm from *AC*. [1]
(ii) equidistant from *AB* and *BC*. [1]

(c) The points *P* and *Q* are 2.5 cm from AC and equidistant from *AB* and *BC*.
Mark and label *P* and *Q*. Measure *PQ*. [1]

2 [P2 NSSC 2009 Q 4]

To the right is a scale drawing of a garden *ABCD*.

Salome wants to plant some roses.

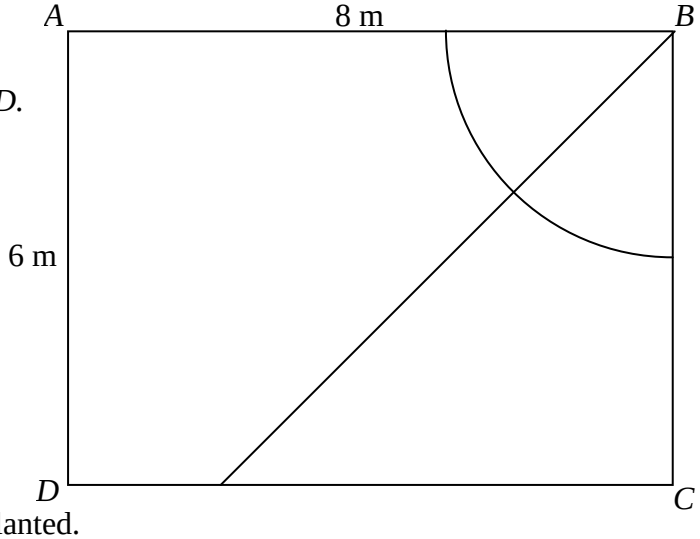
The roses must be planted

① further than 3 m from point *B*,

② nearer to *AB* than to *BC*,

③ nearer to *B* than to *A*.

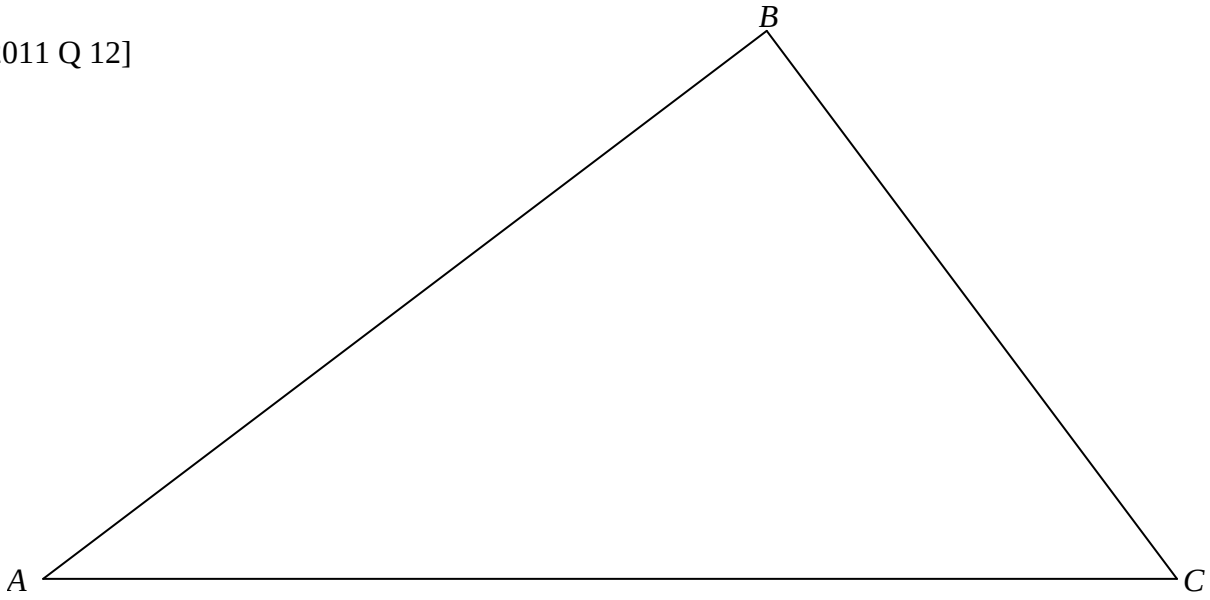
Conditions ① and ② are already constructed on the diagram.



(a) Use ruler and compasses to construct condition ③ on the diagram. [2]

(b) Shade the region in which the roses can be planted. [2]

3 [P2 NSSC 2011 Q 12]



A treasure is hidden on the island *ABC*, shown in the scale drawing above, where 1 cm represents 10 m.
The treasure is nearer to *AB* than to *BC*, less than 15 m from the line *AC*, but more than 70 m from point *A*.

(a) Using a straight edge and compass only, construct on the scale drawing the locus of points within triangle ABC which are

(i) equidistant to from *AB* and *BC*. [2]

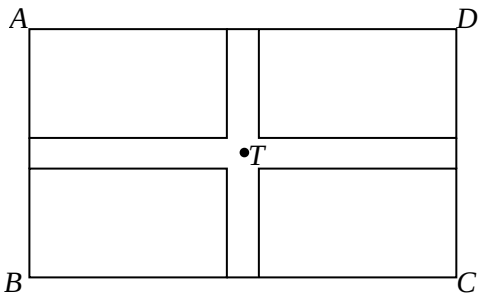
(ii) 15 meters from *AC* [1]

(iii) 70 meters from *A*. [1]

(b) Write the letter *T* in the region where the treasure is hidden. [1]

4 [P4 NSSC 2014 Q 6]

A rectangular garden measures 13 m by 5 m. A tree, *T*, is in the middle of the garden.
Paths of 1 m wide leads to the tree, *T*, as shown in the diagram.



NOT TO SCALE

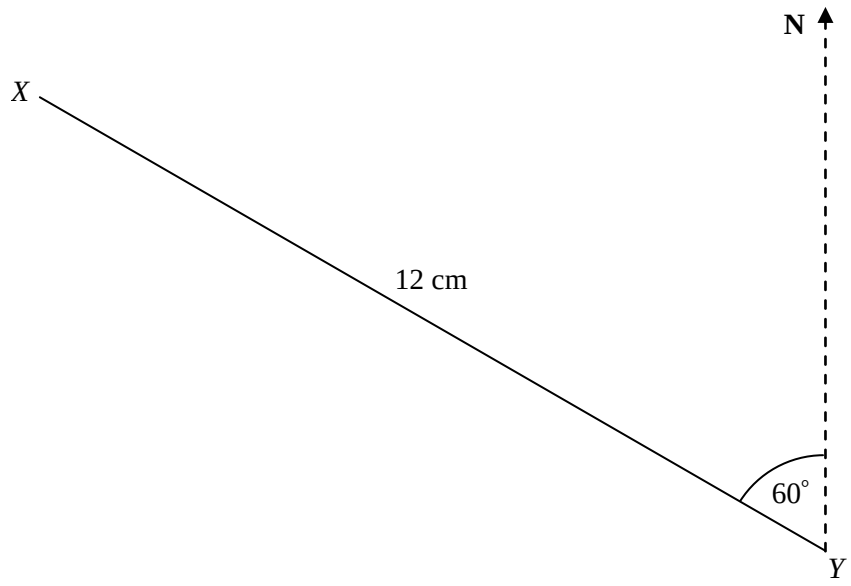
Grass is going to be planted according to the following conditions:

- Grass will be planted at least 1 m from the edge of the garden.
- Grass will be planted closer to the boundary *BC* than *CD*.
- Grass will be planted more than 3 m from the tree.
- Grass will not be planted on the paths.

(a) Using a scale of 1 cm = 1 m, draw a scale drawing of the garden. [2]

(b) Draw the locus of points where the grass can be planted.
Shade the area where the grass can be planted. [7]

5 [P4 NSSC 2015 Q 7]



Two corners, *X* and *Y* , of a horizontal triangular park are 360 m apart. The diagram to the left is part of a scale drawing of the field.

(a) Find the scale of the drawing in the form 1 : *n* [1]

(b) Find the bearing of *X* from *Y* .[1]

The third corner, *Z*, of the field is south of *XY*. It is 300 m from *X* and 240 m from *Y*.

(c) Using a ruler and a compass only, find and label the position of *Z*. [3]

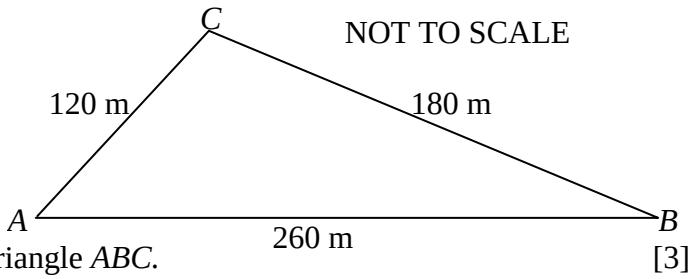
(d) A tree, *T*, in the field is equidistant from the three corners *X*, *Y* and *Z*.

(i) Showing your construction arcs clearly, find and label the position of the tree. [3]

(ii) Measure and find the actual distance of the tree from the corners of the field. [2]

6 [P4 NSSC 2016 Q9(a)]

The boundary of a park is in the shape of a triangle, *ABC* as shown in the diagram. *AB* = 260m, *BC* = 180m and *AC* = 120m.



(a) (i) Using a scale of one centimeter to represent 20 metres, construct an accurate scale drawing of triangle *ABC*. [3]

(ii) Using a straight edge and compasses only, construct the bisector of angle *ACB* on your diagram. [2]

(iii) Using a straight edge and compasses only, construct the locus of points **inside** your triangle, which are equidistant from *B* and *C*. [2]

(iv) Flowers are planted in the park so that they are nearer to *C* than to *B* and nearer to *AC* than to *BC*. **Shade** the region inside your triangle which shows where the flowers are planted. [1]

Section 27 Transformations

1 [P1 Oct/Nov 2011 Q 27 (Adjusted)]

The diagram to the right shows triangles A, B and C.

(a) Triangle A is mapped onto B by an anticlockwise rotation. Write down:

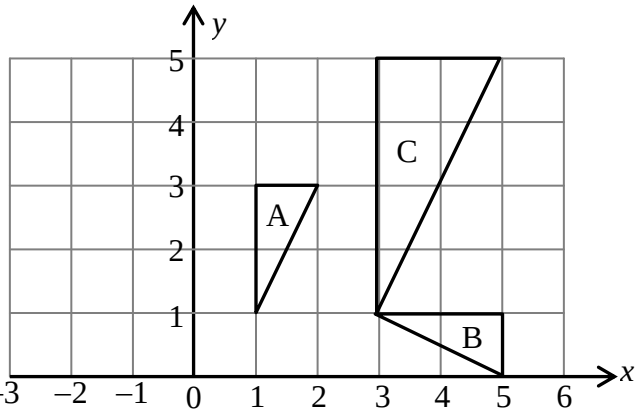
(i) the angle of rotation [1]

(ii) the centre of the rotation. [2]

(b) Triangle A is mapped onto C by an enlargement. Write down

(i) the scale factor of the enlargement [1]

(ii) The centre of the enlargement. [1].



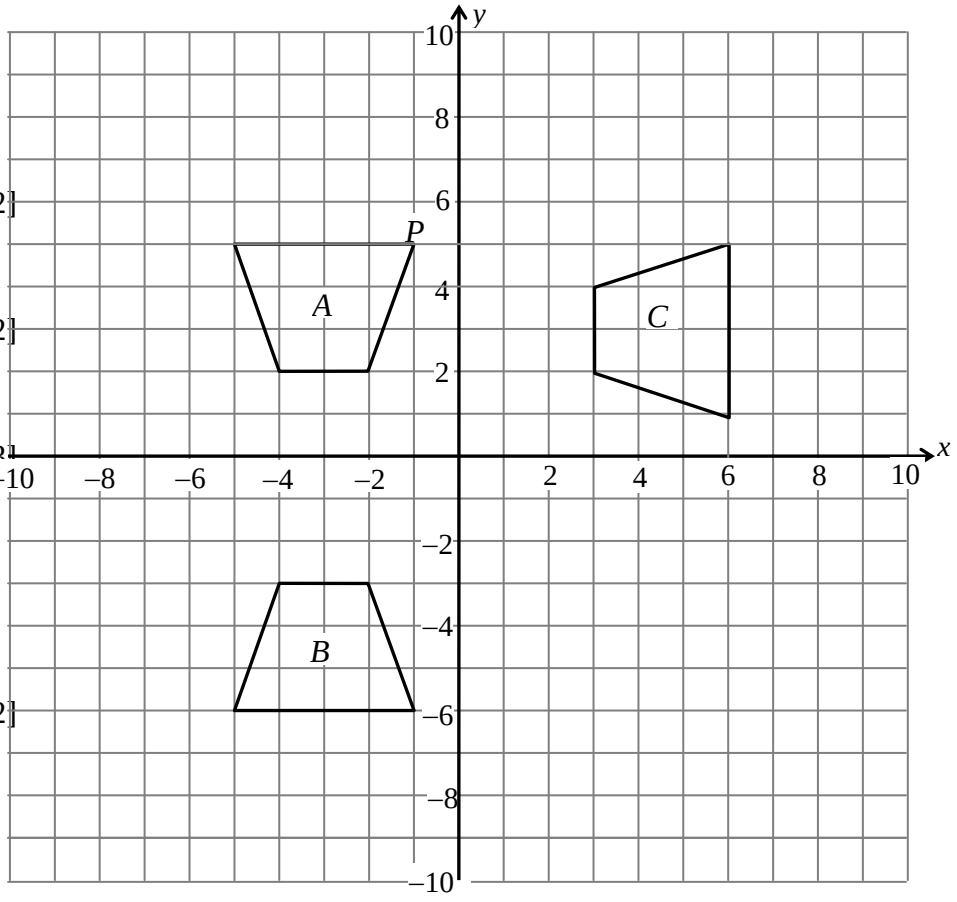
2 [P4 NSSC 2008 Q 4]

(a) describe fully a single Transformation that maps *A* onto *B*. [2]

(b) **(i)** Describe fully a single transformation that maps *B* onto *C*. [2]

(ii) Describe another single transformation that maps *B* onto *C*. [2]

(c) *A* is enlarged with a factor of enlargement being –2 and the origin as the centre of the enlargement.
Write down the coordinates of the image of point *P*. [2]



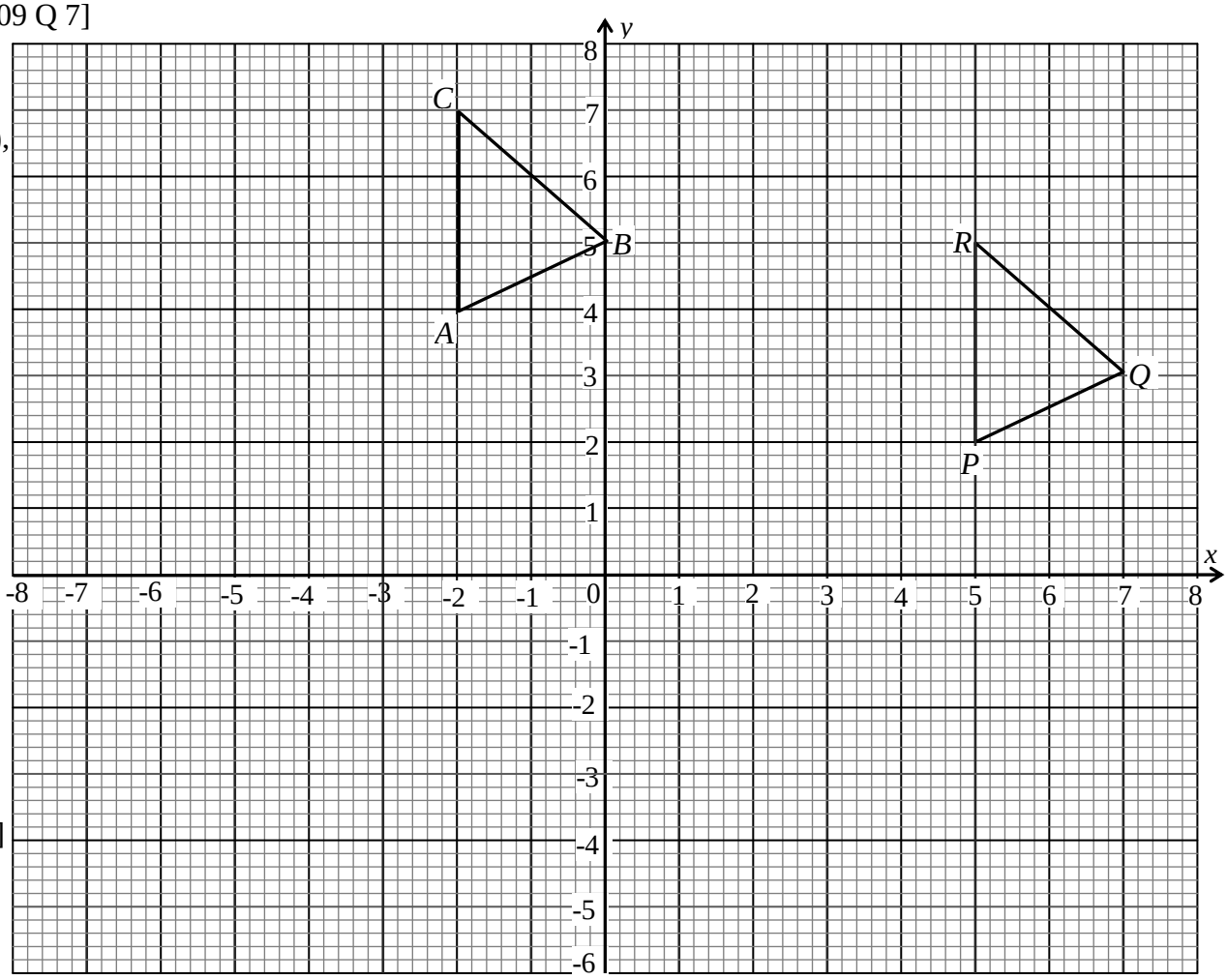
3 [P2 NSSC 2009 Q 7]

On the grid, *P*, *Q* and *R* are the points (5, 2), (7, 3) and (5, 5) respectively.

(a) Draw the reflection of triangle *PQR* in the line $y = 1$. Label the image $P_1Q_1R_1$ [1]

(b) Rotate triangle *PQR* through 180° about the point (1, 1). Label the image $P_2Q_2R_2$ [2]

(c) Describe fully the transformation which maps triangle *PQR* onto triangle *ABC*. [2]



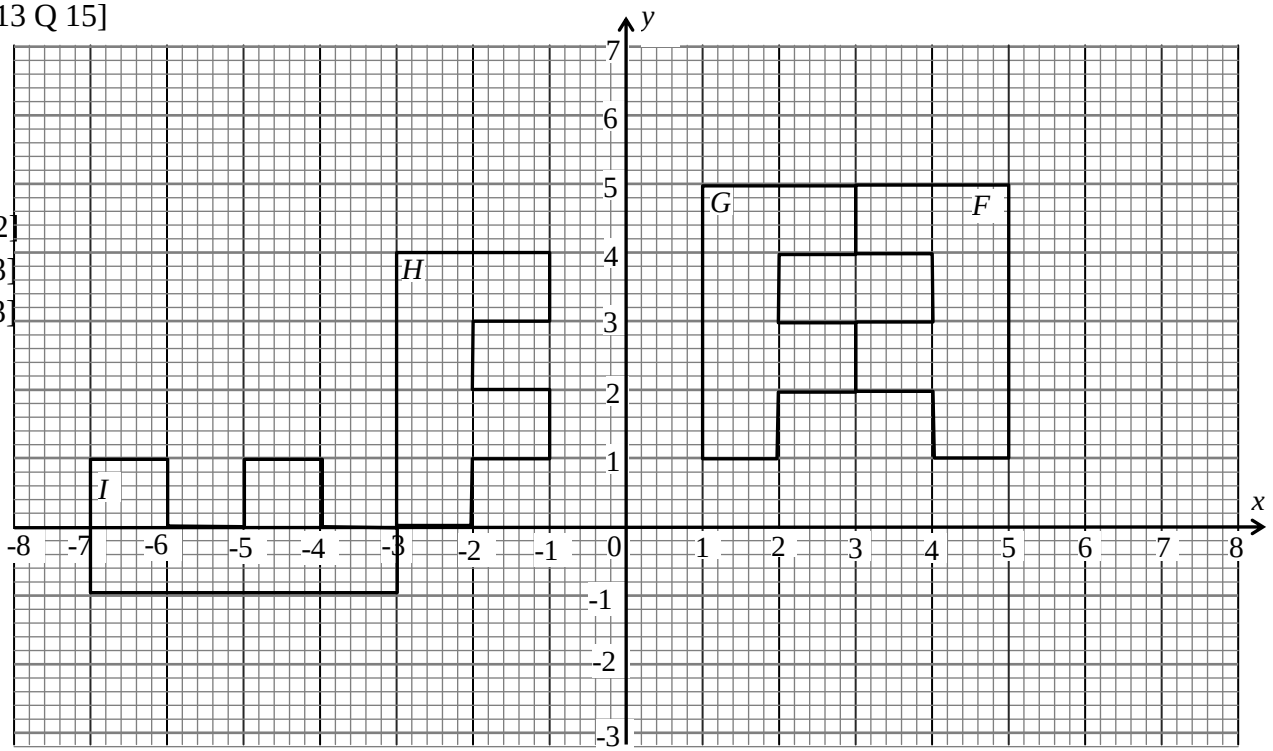
4 [P2 NSSC 2013 Q 15]

Describe fully the single transformation which maps

(a) *G* onto *F* [2]

(b) *G* onto *H* [3]

(c) *G* onto *I* [3]



5 [P2 NSSC 2014 Q 18]

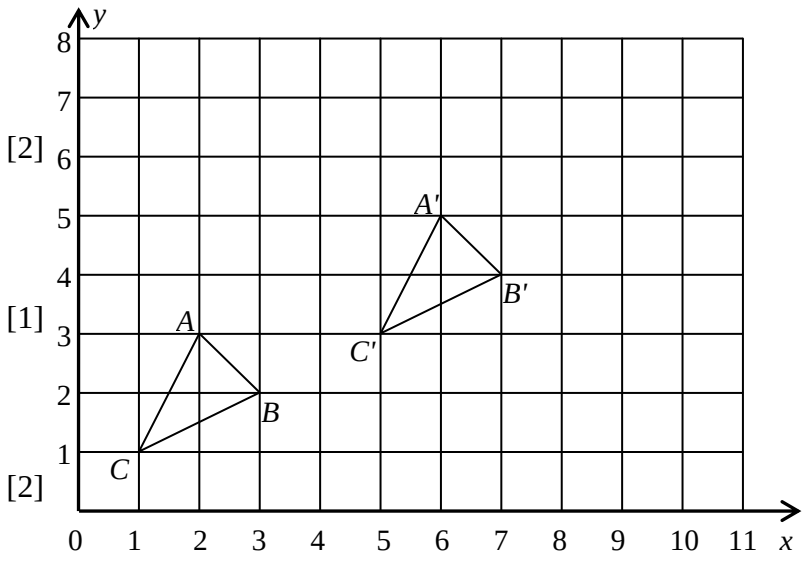
(a) Using the grid to the right, describe the transformation that maps triangle *ABC* onto triangle *A'B'C'* [2]

(b) Triangle *ABC* is enlarged by a scale factor 2, through the origin to form triangle *A''B''C''*. Write down the coordinates of the vertices of point *A''* after this transformation. [1]

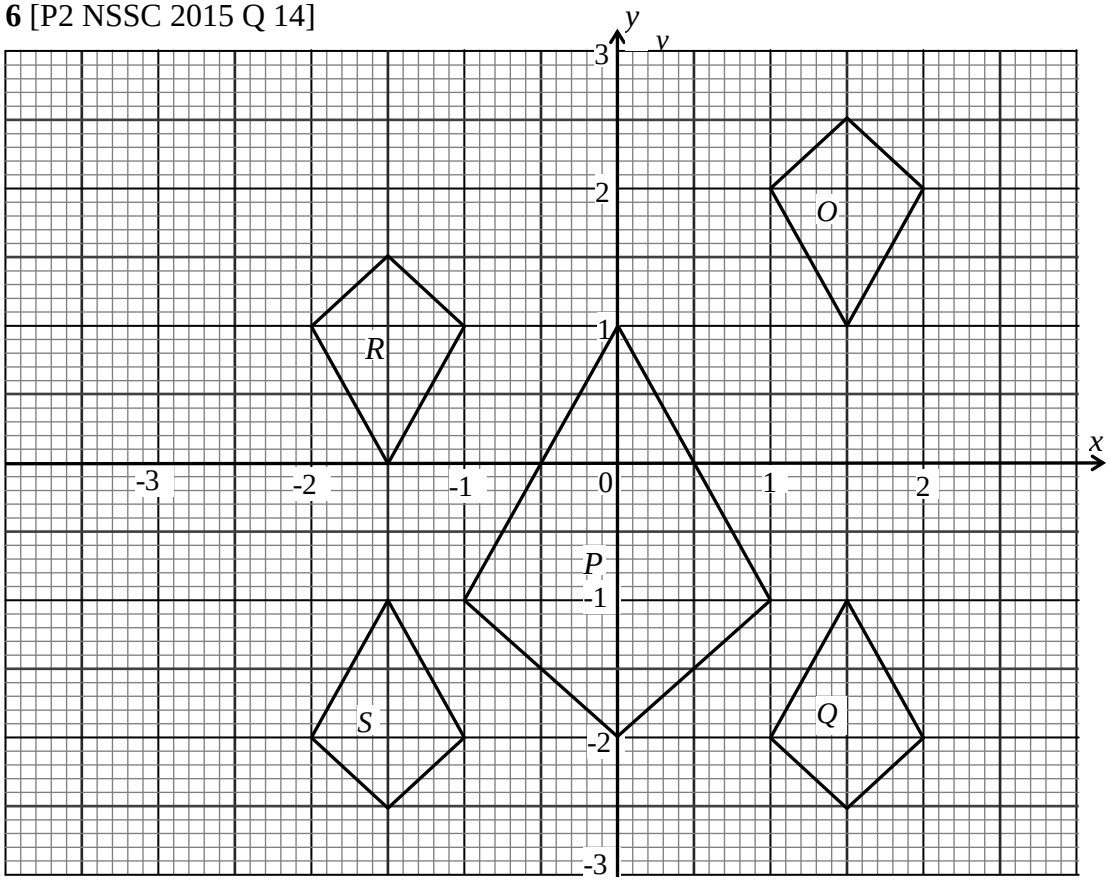
(c) Use the symbols ≡ or ||| to complete the following statements.

(i) Triangle *ABC* ……. to triangle *A'B'C'*

(ii) Triangle *ABC* ……. to triangle *A''B''C''* [2]



6 [P2 NSSC 2015 Q 14]



Describe fully the single transformation which maps

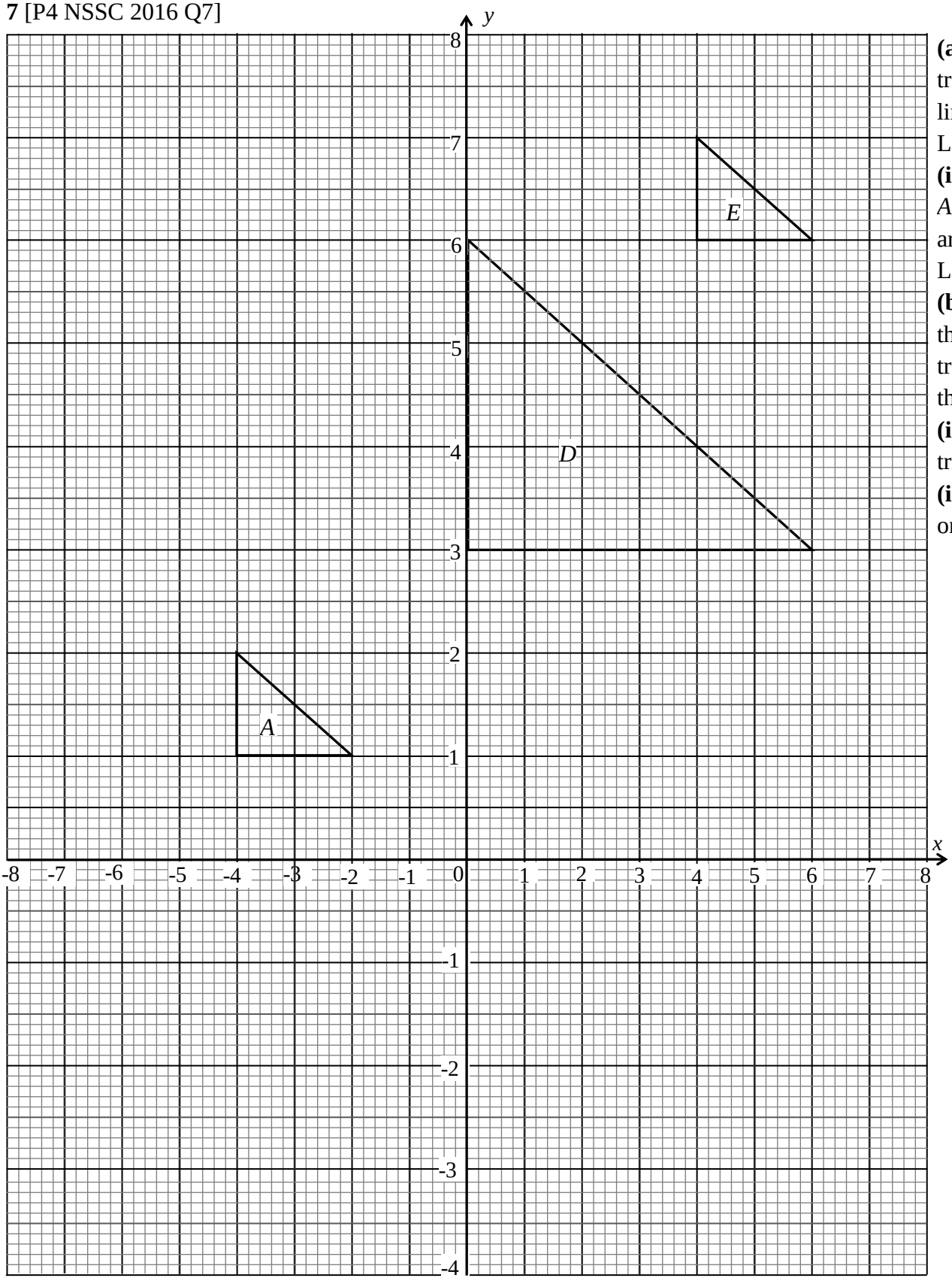
(a) kite *O* onto kite *P* [3]

(b) kite *O* onto kite *Q* [2]

(c) kite *O* onto kite *R* [2]

(d) kite *O* onto kite *S* [3]

7 [P4 NSSC 2016 Q7]



(a) (i) Reflect triangle *A* in the line $y = 4$. Label it *B* [1]

(ii) Rotate triangle *A* through 180° around the origin. Label it *C*. [2]

(b) Describe **fully** the single transformation that maps

(i) triangle *A* onto triangle *E*. [3]

(ii) triangle *D* onto triangle *A*. [3]

Section 28 Trigonometry

1 [P1 May June 2003 Q 22 (b)]

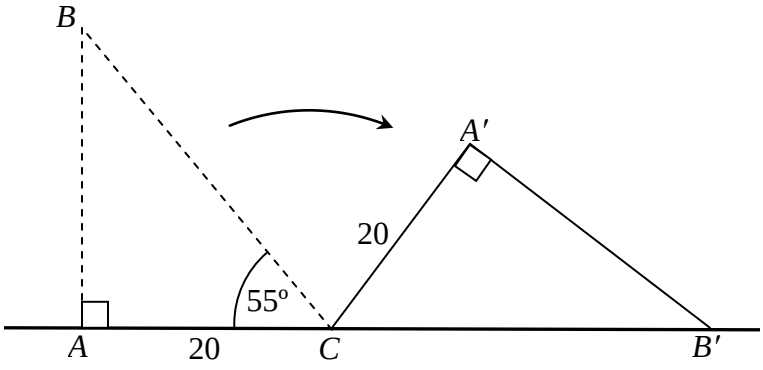
A triangle has sides of 6 cm and 5 cm. The angle in between these two sides is 150º.

Calculate the area of the triangle. [2]

2 [P2 May/June 2005 4 (a)]

In triangle *ABC*, $\angle BAC = 90º$, $\angle BCA = 55º$ and *AC* = 20 cm. The triangle initially stood with *AC* on a horizontal surface.

It was then rotated about the point *C* onto triangle *A′B′C′* where *ACB′* is a straight line.



Calculate

(a) the length of *BC* [2]

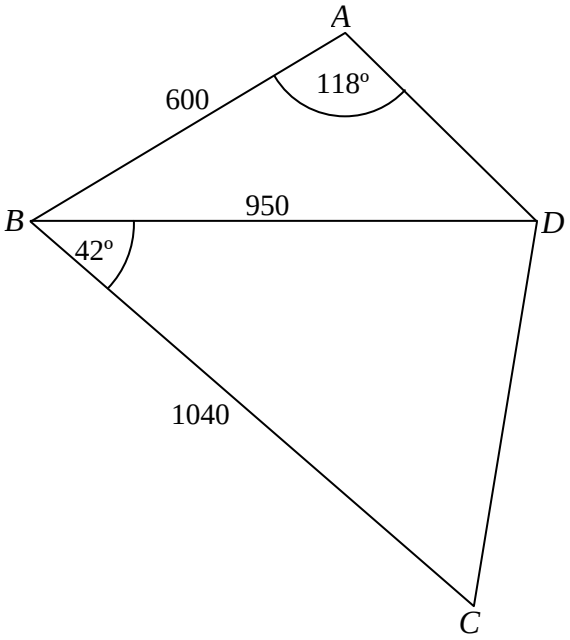
(b) the distance *AB′* [1]

(c) the height of *A′* above *CB′* [2]

3 [P2 May/June 2005 Q 9]

In the diagram, the quadrilateral *ABCD* represents a level park with a path *BD*.

AB = 600 m, *BC* = 1040 m, *BD* = 950 m, $\angle CBD = 42º$ and $\angle BAD = 118º$.



(a) Calculate

(i) angle *ABD* [4]

(ii) the length of *CD* [4]

(iii) the shortest distance from *C* to *BD*. [2]

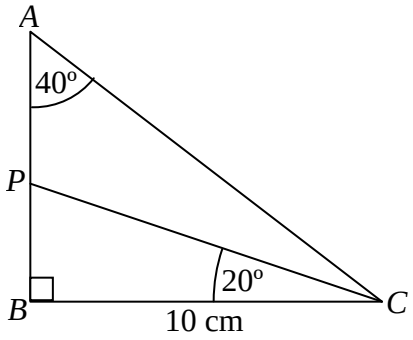
(b) A helicopter flew directly above the path *BD* at a constant height of 500 m

Calculate the greatest angle of depression of the point *C* as seen by a passenger in the helicopter. [2]

4 [P2 Oct/Nov 2011 Q 1]

ABC is a triangle with $\angle ABC = 90º$, $\angle BAC = 40º$ and *BC* = 10 cm

P is the point on *AB* such that $\angle PCB = 20º$



Calculate

(a) *PB* [2]

(b) *AP* [2]

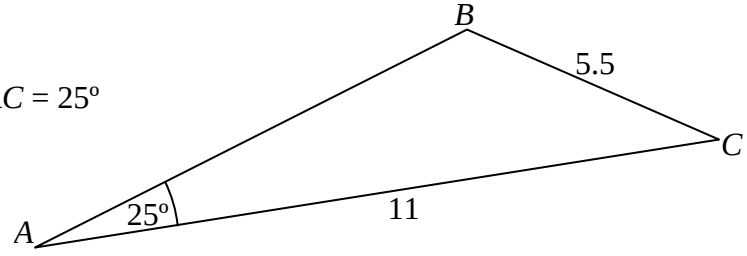
(c) the perimeter of triangle PBC [3]

5 [P2 Oct/Nov 2011 Q 9 (a)]

In the diagram, *AC* = 11 cm, *BC* = 5.5 cm and $\angle BAC = 25º$

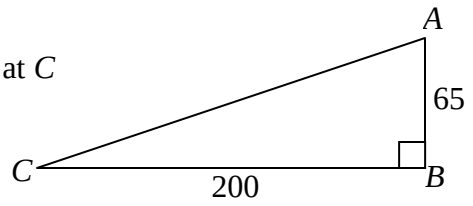
It is given that angle *ABC* is an **obtuse** angle.

Calculate angle *ABC*. [4]



6 [P2 Oct/Nov 2007 Q 1 (a)]

From the top of a vertical tower, *AB*, an observer sees a car at *C*
AB = 65 m and *CB* = 200 m.
Calculate angle *CAB* [2]

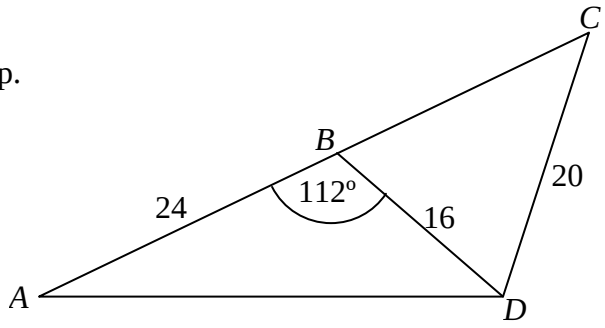


7 [P2 Oct/Nov 2007 Q 5]

The points *A, B, C* and *D* represent four towns on a map.
ABC is a straight line.
AB = 24 cm, *BD* = 16 cm and *CD* = 20 cm.
Angle *ABD* = 112º.

(a) Calculate
(i) *AD* [4]
(ii) angle *BCD* [3]
(iii) the area of triangle *ABD* [2]

(b) The scale of the map is 1 : 250 000.
Calculate the actual distance, in kilometers, from town *A* to town *B* [1]

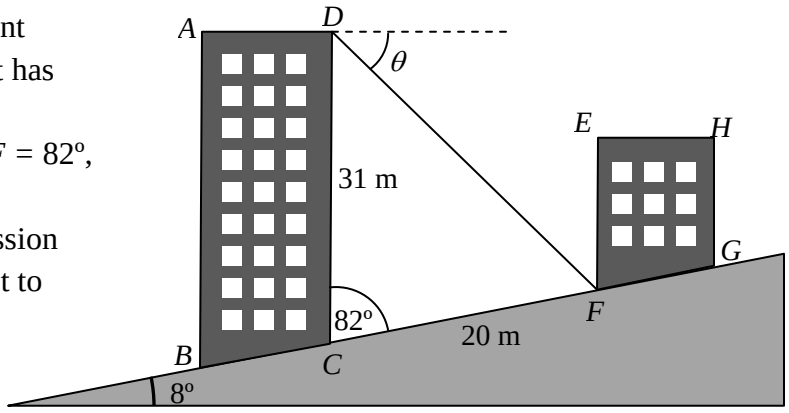


8 [P2 NSSC 2013 Q 17]

In the diagram, *ABCD* and *EFGH* represent Vertical buildings on a slanted ground that has A constant inclination of 8º.
If *DC* = 31 m, *CF* = 20 m and angle *DCF* = 82º,

(a) Show that *DF* = 34.5 m [3]

(b) Find the value of θ, the angle of depression of *F* from *D*. Give your answer correct to one decimal place. [3]

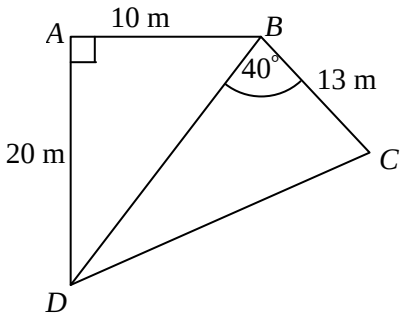


9 [P4 NSSC 2014 Q 8]

The diagram represents four players *A, B, C* and *D* on a netball court. The diagram shows their positions relative to each other on the court.

(a) Calculate the distance between players *C* and *D*. [5]

(b) Calculate the value of
(i) angle *ADB*, [2]
(ii) angle *BDC* [3]



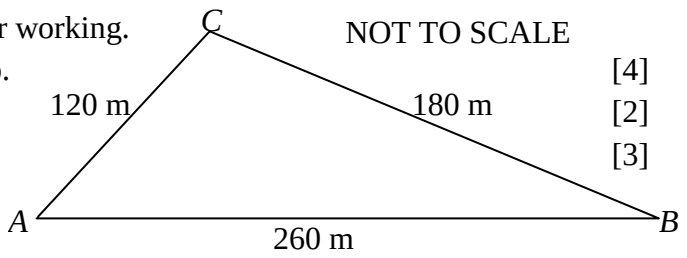
10 [P4 NSSC 2016 Q 9(b)]

Use trigonometry only to solve this question. Show all your working.

(i) Show clearly that angle *ACB* = 118.8° correct to one d.p. [4]

(ii) Calculate the area of the park. [2]

(iii) Calculate angle *BAC*. [3]



Section 29 Graphs of functions

1 [Paper 2 May/June 2005 Q 8]

Answer the whole of this question on a graph paper.

During one day, at a point *P* in a small harbor, the height of the surface of the sea above the seabed was noted. The results are shown in the table.

Time (*t* hours) after 8 a m.	0	1	2	3	4	5	6	7	8	9
Height (*y* meters) above the sea-bed	3.8	3.3	2.5	1.8	1.2	1.0	1.2	1.8	2.5	3.3

(a) Using a scale of 1 cm to represent 1 hour, draw a horizontal *t*-axis for $0 \leq t \leq 9$

Using a scale of 2 cm to represent 1meter, draw a vertical *y*-axis for $0 \leq t \leq 4$

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(b) (i) By drawing a tangent, find the gradient of the curve at the point where $t = 4$. [2]

(ii) Explain the meaning of the gradient. [1]

(c) On the same day, a straight pole was driven vertically into the sea-bed at the point *P*.

Work started at 8 a.m. The pole was driven in, at a constant rate.

The height, *y* meters, of the top of the pole above the sea-bed, *t* hours after 8 a.m., is given by the equation $y = 4 - \frac{1}{2}t$

(i) Write down the length of the pole [1]

(ii) On the same axes as the curve, draw the graph of $y = 4 - \frac{1}{2}t$ [2]

(iii) How many **centimeters** was the top of the pole above the surface of the sea at noon? [2]

(iv) Find the value of *t* when the top of the pole was level with the surface of the sea. [1]

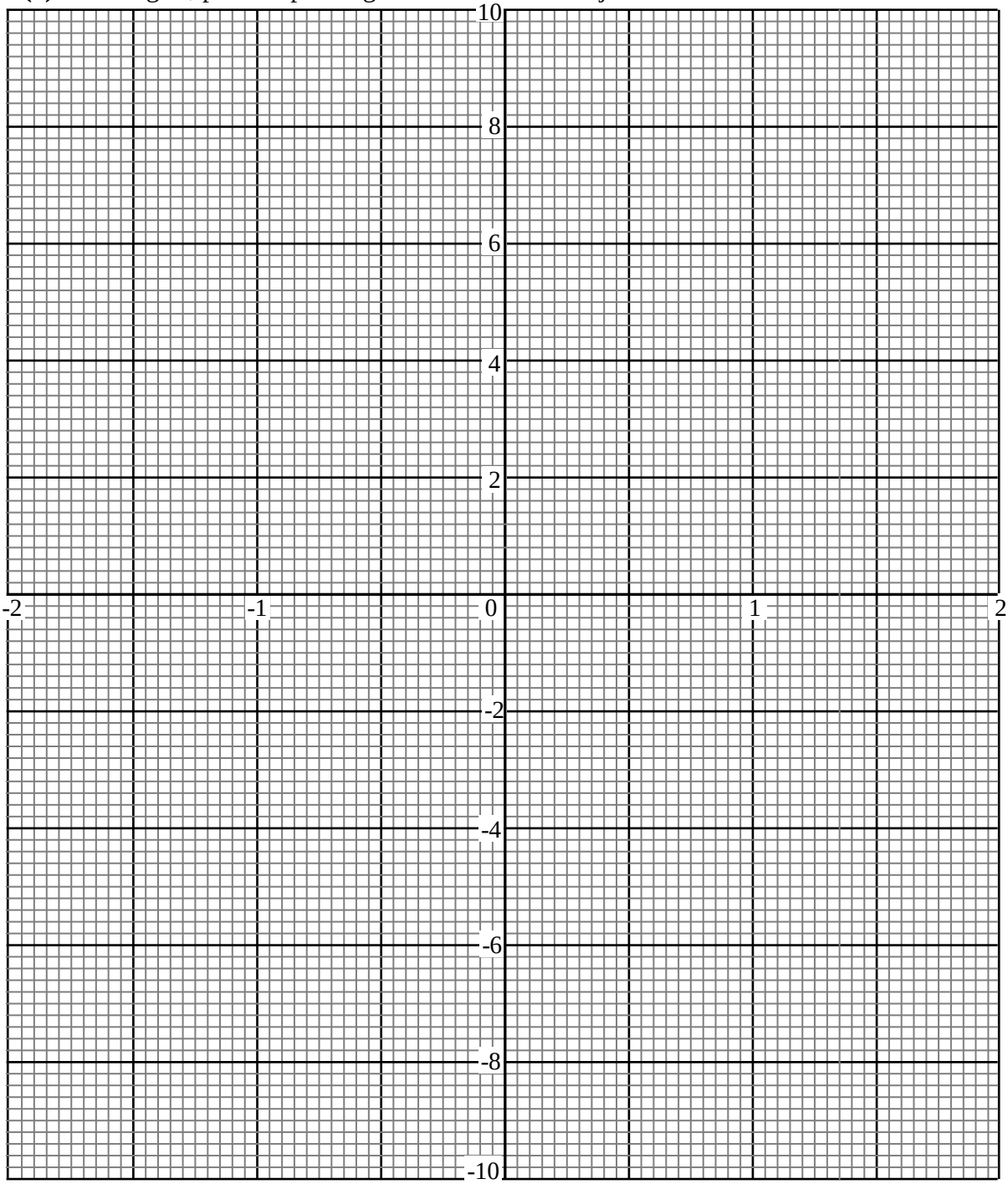
2 [P2 Oct/Nov 2011 Q 8]

The variables x and y are connected by the equation $y = 2x - \frac{5}{2x}$

The table below shows some values of x and the corresponding values of y. The values of y are correct to 1 decimal place where appropriate.

x	0.25	0.5	0.75	1	1.25	1.5	1.75	2
y	–9.5	–4	–1.8	–0.5	0.5	1.3	2.1	2.8

(a) On the grid, plot the points given in the table and join them with a smooth curve.



(b) by drawing a tangent find the gradient of the curve at the point (0.75 , –1.8). [2]

(c) The line $y = 2 - x$ intersects the curve $y = 2x - \frac{5}{2x}$ at P.

(i) on the grid, draw the graph of the straight line $y = 2 - x$ [2]

(ii) write down the coordinates of P. [1]

(iii) This value of x is a solution of the equation $6x^2 - Bx - C = 0$ Find B and C [3]

(d) Let $f(x) = 2x - \frac{5}{2x}$

(i) Given that $f(a) = b$, Show that $f(-a) = -b$. [1]

(ii) Hence, using the table on the previous page, draw the graph of $y = 2x - \frac{5}{2x}$ For $-2 \leq x \leq -0.25$. [1]

3 [P2 Oct/Nov 2007 Q 8]

Answer the whole of this question on a graph paper.

A stone was thrown from the top of a vertical cliff. Its position during the flight is represented by the equation $y = 24 + 10x - x^2$, where y meters is the height of the stone above the sea and x meters is the horizontal distance from the cliff.

(a) Solve the equation $0 = 24 + 10x - x^2$ [2]

(b) The table shows some values of x and the corresponding values of y.

x	0	2	4	6	8	10
y	24	40	48	48	40	24

(i) Using a scale of 1 cm to represent 1 meter, draw a horizontal x-axis for $0 \le x \le 14$.
Using a scale of 2 cm to represent 10 meters, draw a vertical y-axis for $0 \le y \le 50$
On your axes, plot the points from the table and join them with a smooth curve [3]

(ii) Use your answer to part **(a)** to complete the graph, which represents the flight of the stone. [1]

(iii) Find the height of the stone above the sea when its horizontal distance from the cliff was 7 m. [1]

(iv) Use your graph to find how far the stone travelled horizontally while it was 6 m or more above the top of the cliff. [2]

(c) It is given that $24 + 10x - x^2 = p - (x - 5)^2$

(i) Find the value of p. [1]

(ii) Hence find

(a) the greatest height of the stone above the sea, [1]

(b) the horizontal distance from the cliff when the stone was at its greatest height. [1]

4 [P4 NSSC 2013 Q 5]

Answer the whole of this question on a sheet of graph paper.

The table below give the values of x and y for the function $y = f(x)$.

x	–2	–1.5	–1	–0.5	0	0.5	1	1.5	2	2.5	3	3.5	4
y	–16	–4.4	3	6.9	8	7.1	5	2.4	0	–1.4	–1	1.9	8

(a) Using 2 cm to represent 1 unit on the x-axis and 2 cm to represent 5 units on the y-axis, draw this Graph for $-2 \le x \le 4$. [5]

(b) Use your graph to solve the equation $f(x) = 0$, giving your answer to 1 decimal place [3]

(c) Writ down a negative value of k such that the equation $f(x) = k$ has 3 solutions [2]

(d) Describe the type of symmetry that this graph shows. [3]

(e) (i) By drawing a suitable tangent, estimate the gradient of the curve at (–1, 3) [3]

(ii) Write down the coordinates of another point where the curve has this gradient. [1]

5 [P2 NSSC 2015 Q 13]

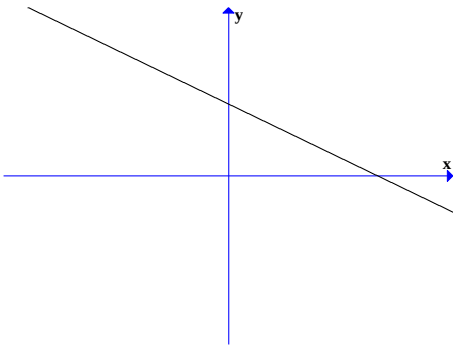


Figure 1

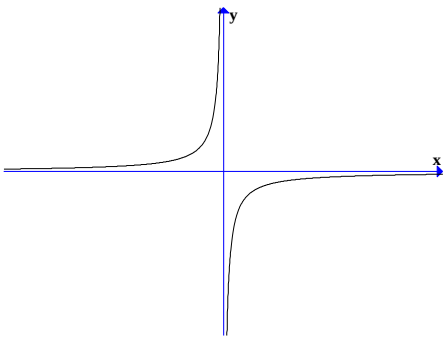


Figure 2

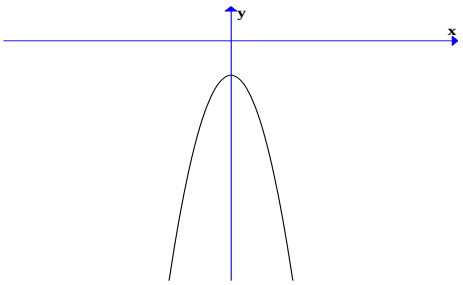


Figure 3

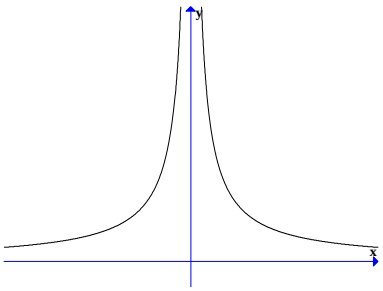


Figure 4

From the figures above, choose the correct figure for each of the following equations.

(a) $y = -2x + 1$ **(b)** $y = -x^2 - 1$ **(c)** $y = \frac{-1}{x}$ [1] each

6 [P4 NSSC 2016 Q8] Below is a table of values of $y = \frac{3}{x^2}$ $(x \neq 0)$, all given correct to one decimal place.

x	−2	−1.5	−1	−0.5	0	0.5	1	1.5	2
y	0.8	s	u	t		t	u	s	0.8

(a) Calculate the values of s, t and u.

(b) Using a scale of 2 cm to represent 0.5 units on the x-axis and 1 cm to represent 1 unit on the y-axis, draw the graph of $y = \frac{3}{x^2}$ for $-2 \leq x \leq -0.5$ and $0.5 \leq x \leq 2$.

(c) Use the graph to solve

(i) $\frac{3}{x^2} = 8$ [2]

(ii) $\frac{3}{x^2} = 2x + 6$ [3]

(d) By drawing a suitable tangent to the curve, find the gradient m, of the curve when $x = 1.5$. [3]

Section 30 Logarithms and exponential equations

1 [P2 NSSC 2008 Q 18]

Use logarithms to solve for x: $0.2^x = 20$ [3]

2 [P4 NSSC 2011 Q 11]

(a) Solve the following equation $3^p = \frac{1}{27}$ [2]

(b) Express the following as a single logarithm in its simplest form $4\log(x + 2) - \frac{1}{2}\log x$ [2]

(c) Using logarithms solve the equation $5^{x+1} = 6$. Show all your working. [3]

(d) Calculate the remainder and quotient when $x^3 - 7x + 6$ is divided by $x + 2$. [4]

3 [P2 NSSC 2009 Q 9]

Solve for x $5^x = 4$ [3]

4 [P2 NSSC 2009 Q 20]

Simplify, by writing the expression as the logarithm of one number $4 \log_{10} 3 - 1$ [3]

5 [P2 NSSC 2007 Q 21]

Write as a single logarithm. $2 - 2 \log_{10} 5$ [3]

6 [P4 NSSC 2007 Q 11]

(a) Vincent wins N$18 000 and invests it at 4.5% **simple interest** per year.
Find the amount Vincent will have after 5 years. [3]

(b) Martha inherits some money. She deposits it at a bank that offers **compound interest** at an annual rate of 4.5%.
The amount of money, M Namibian dollars in her account, after t years is $M = 15\,000 \times 1.045^t$

(i) State the initial amount of money she deposited. [1]

(ii) Calculate, correct to the nearest N$, the amount of money in Martha's account after 5 years. [2]

(c) Martha wants to know how many years it will take for her money to increase to an amount of N$25 000.

(i) Show that this information simplifies to the $1.045^t = \frac{5}{3}$ [2]

(ii) Use logarithms to find t correct to 3 significant figures. [3]

7 [P4 NSSC 2013 Q 8(ab)]

(a) Simplify $\log p + 2 \log q - 3 \log r$ [3]

(b) Solve the equation $3^{x-1} = 11$ [3]

8 [P2 NSSC 2014 Q 14]

Solve x $\frac{\log x}{\log 2x} = 2$ [4]

9 [P2 NSSC 2015 Q 8]

(a) Write $2 \log x - 5 \log y + 1$ as a single logarithm. [3]

(b) Solve $3^{2x} = 5$, correct to 1 decimal place. [3]

10 [P4 NSSC 2016 Q6cd]

(c) **(i)** Find the value of x for which $2 \times 3^{x+5} = 43.74$ [3]

(ii) $\dfrac{2}{x-2} + \dfrac{x+1}{4} = 3.$ [5]

(d) If log 2 = a and log 3 = b, determine the value of log 12 in terms of a and b. [3]