

## Intermediate 2 - Past Paper Questions

### FORMULAE LIST

The roots of  $ax^2 + bx + c = 0$  are  $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Sine rule:  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule:  $a^2 = b^2 + c^2 - 2bc \cos A$  or  $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

Area of a triangle:  $\text{Area} = \frac{1}{2}ab \sin C$

Volume of a sphere:  $\text{Volume} = \frac{4}{3}\pi r^3$

Volume of a cone:  $\text{Volume} = \frac{1}{3}\pi r^2 h$

Volume of a cylinder:  $\text{Volume} = \pi r^2 h$

Standard deviation:  $s = \sqrt{\frac{\sum(x - \bar{x})^2}{n-1}} = \sqrt{\frac{\sum x^2 - (\sum x)^2/n}{n-1}}$ , where  $n$  is the sample size.

Outcome	Topic	Pages
1.1	Calculations involving Percentages	2
1.2	Volumes of Solids	3-7
1.3	Linear relationships	8-9
1.4	Algebraic Operations 1	10-11
1.5	Properties of Circles	12-19
2.1	Trigonometry	20-24
2.2	Simultaneous Linear Equations	25-26
2.3	Graphs, Charts & Tables (SIQR & Probability)	27-32
2.4	Simple Statistics	33-36
3.1	Algebraic Operations 2	37-40
3.2	Quadratic Functions	41-46
3.3	Further Trigonometry	47-52

## 1.1 Calculations involving Percentages

### 1. 2010 Paper 2

An industrial machine costs £176 500.

Its value depreciates by 4.25% each year.

How much is it worth after 3 years?

Give your answer correct to **three** significant figures.

4

### 2. 2009 Paper 2

A new book “Intermediate 2 Maths is Fun” was published in 2006.

There were 3000 sales of the book during that year.

Sales rose by 11% in 2007 then fell by 10% in 2008.

Were the sales in 2008 more or less than the sales in 2006?

**You must give a reason for your answer.**

3

### 3. 2008 Paper 2

Calculate the **compound interest** earned when £50 000 is invested for 4 years at 4.5% per annum.

Give your answer to the nearest penny.

4

### 4. 2007 Paper 2

Ian’s annual salary is £28 400. His boss tells him that his salary will increase by 2.3% per annum.

What will Ian’s annual salary be after 3 years?

Give your answer to the nearest pound.

3

### 5. 2006 Paper 2

The value of a boat decreased from £35 000 to £32 200 in one year.

(a) What was the percentage decrease?

1

(b) If the value of the boat continued to fall at this rate, what would its value be after a **further** 3 years?

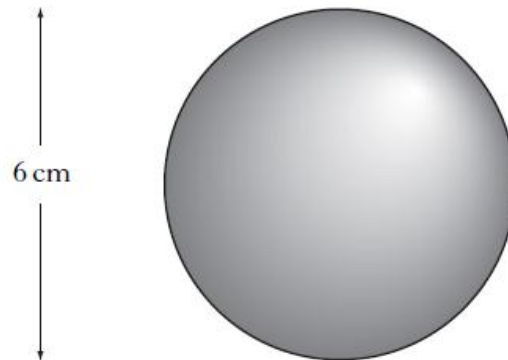
Give your answer to the nearest hundred pounds.

3

## 1.2 Volumes of Solids

1. 2010 Paper 1

The diagram below represents a sphere.



The sphere has a diameter of 6 centimetres.

Calculate its volume.

Take  $\pi = 3 \cdot 14$ .

2

2. 2010 Paper 2

A cylindrical container has a volume of 3260 cubic centimetres.

The radius of the cross section is 6.4 centimetres.

Calculate the height of the cylinder.

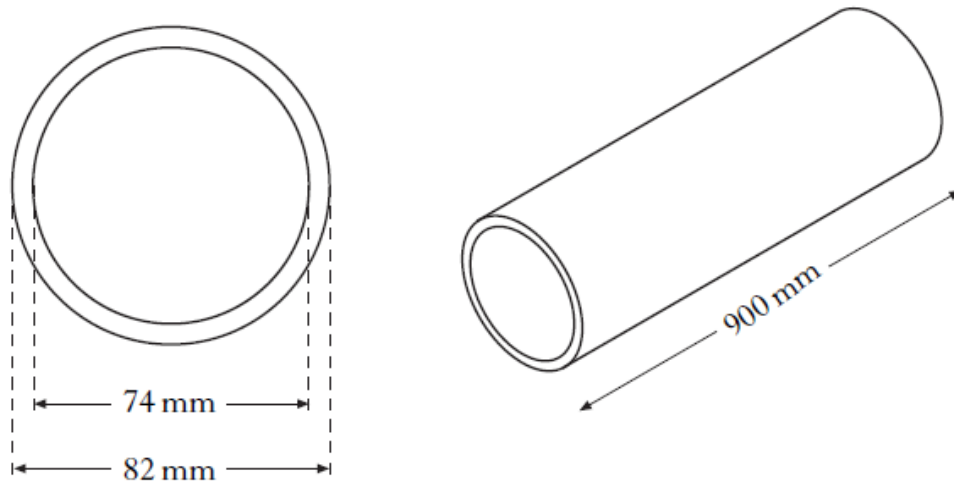


3

3. 2009 Paper 2

A company manufactures aluminium tubes.

The cross-section of one of the tubes is shown in the diagram below.



The inner diameter is 74 millimetres.

The outer diameter is 82 millimetres.

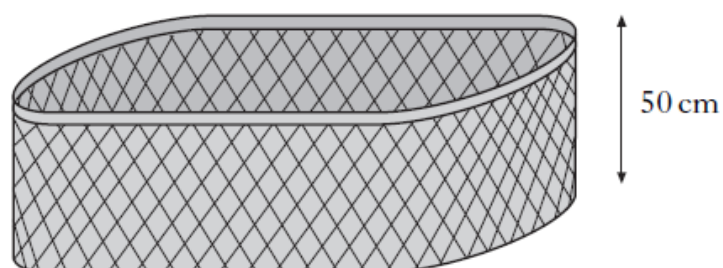
The tube is 900 millimetres long.

Calculate the volume of aluminium used to make the tube.

**Give your answer correct to three significant figures.**

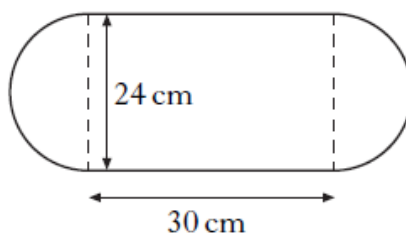
4. 2008 Paper 2

Jim Reid keeps his washing in a basket. The basket is in the shape of a prism.



The height of the basket is 50 centimetres.

The cross section of the basket consists of a rectangle and two semi-circles with measurements as shown.

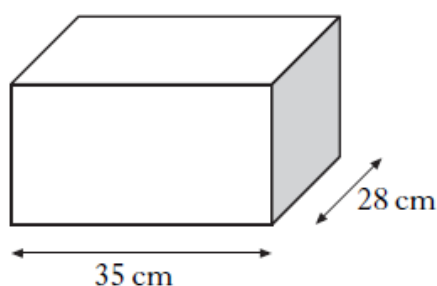


(a) Find the volume of the basket in cubic centimetres.

Give your answer correct to three significant figures.

4

Jim keeps his ironing in a storage box which has a volume **half** that of the basket.



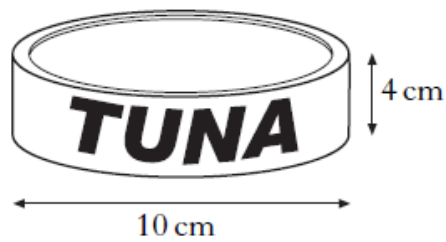
The storage box is in the shape of a cuboid, 35 centimetres long and 28 centimetres broad.

(b) Find the height of the storage box.

3

5. 2007 Paper 1

A tin of tuna is in the shape of a cylinder.



It has diameter 10 centimetres and height 4 centimetres.

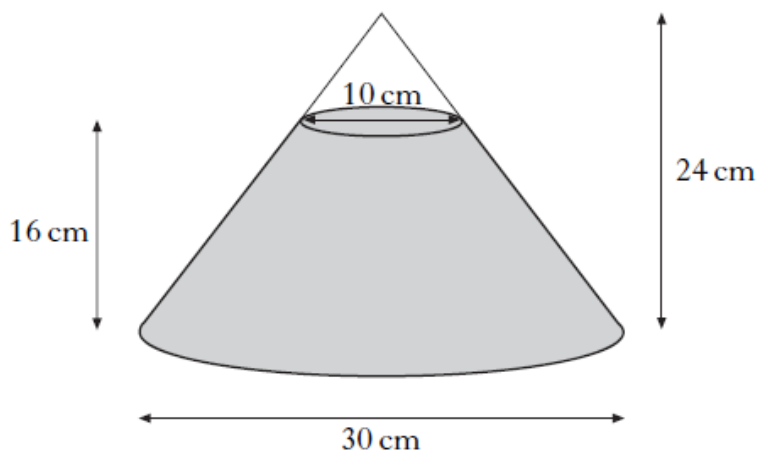
Calculate its volume.

Take  $\pi = 3.14$ .

2

6. 2007 Paper 2

A glass ornament in the shape of a cone is partly filled with coloured water.



The cone is 24 centimetres high and has a base of diameter 30 centimetres.

The water is 16 centimetres deep and measures 10 centimetres across the top.

What is the volume of the water?

Give your answer correct to 2 significant figures.

5

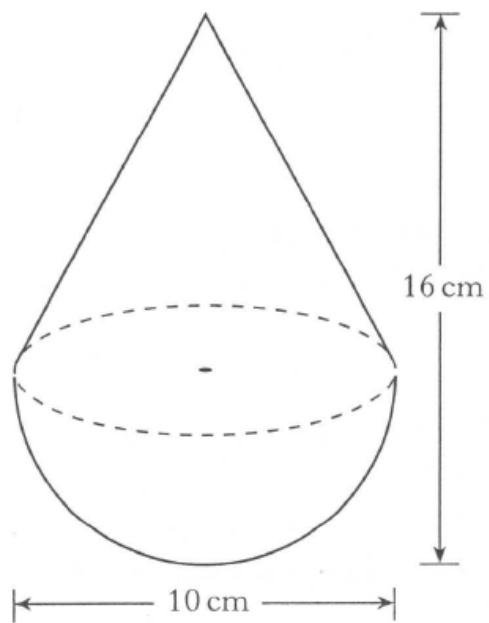
7. 2006 Paper 2

A child's toy is in the shape of a hemisphere with a cone on top, as shown in the diagram.

The toy is 10 centimetres wide and 16 centimetres high.

Calculate the volume of the toy.

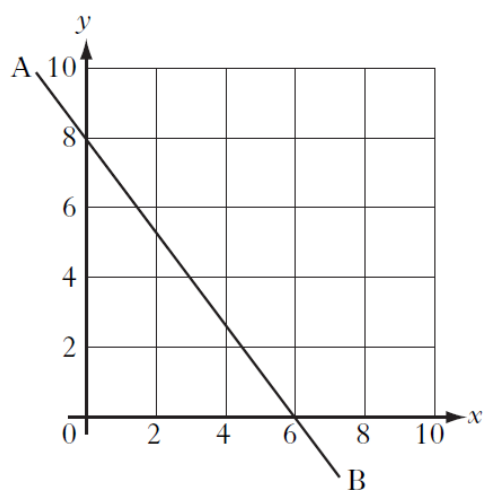
Give your answer correct to 2 significant figures.



5

### 1.3 Linear Relationships

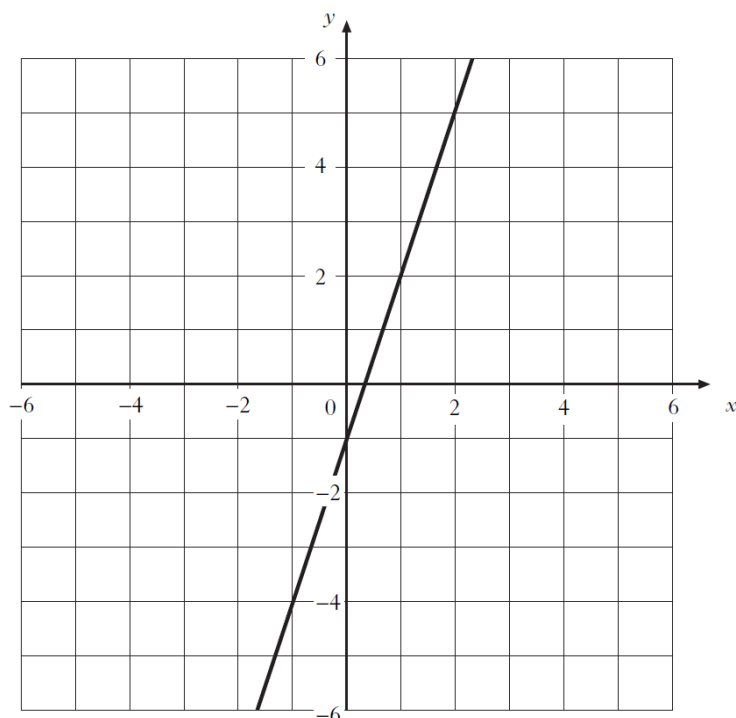
1. 2010 Paper 1



Find the equation of the straight line AB shown in the diagram.

3

2. 2009 Paper 1



Find the equation of the straight line shown in the diagram.

3

3. 2009 Paper 1

A straight line is represented by the equation  $x + y = 5$ .

Find the gradient of this line.

2



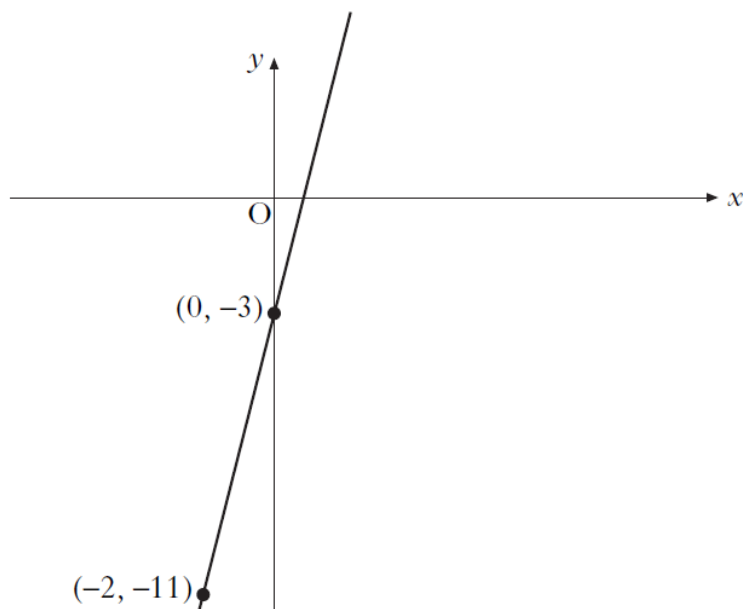
4. 2008 Paper 1

A straight line has equation  $y = 4x + 5$ .

State the gradient of this line.

1

5. 2007 Paper 1



Find the equation of the straight line passing through the points  $(0, -3)$  and  $(-2, -11)$ .

3

6. 2007 Paper 1

A straight line is represented by the equation  $y = ax + b$ .

Sketch a possible straight line graph to illustrate this equation when  $a = 0$  and  $b > 0$ .

2

7. 2006 Paper 1

A straight line is represented by the equation  $2y + x = 6$ .

(a) Find the gradient of this line.

2

(b) This line crosses the  $y$ -axis at  $(0, c)$ .

Find the value of  $c$ .

1

## 1.4 Algebraic Operations

1. 2010 Paper 1

(a) Factorise

$$x^2 + x - 6. \quad 2$$

(b) Multiply out the brackets and collect like terms.

$$(3x + 2)(x^2 + 5x - 1) \quad 3$$

2. 2009 Paper 1

Factorise

$$x^2 - 5x - 24. \quad 2$$

3. 2009 Paper 1

Multiply out the brackets and collect like terms.

$$(x + 5)(2x^2 - 3x - 1) \quad 3$$

4. 2008 Paper 1

Multiply out the brackets and collect like terms.

$$(3x + 2)(x - 5) + 8x \quad 3$$

5. 2008 Paper 1

(a) Factorise

$$x^2 - y^2. \quad 1$$

(b) Hence, or otherwise, find the value of

$$9 \cdot 3^2 - 0 \cdot 7^2. \quad 2$$

6. 2007 Paper 1

Multiply out the brackets and collect like terms.

$$(x + 3)(x^2 + 4x - 12) \quad 3$$

7. 2007 Paper 2

(a) Factorise **fully**

$$2x^2 - 18.$$

2

(b) Simplify

$$\frac{(2x+5)^2}{(2x-1)(2x+5)}.$$

1

8. 2006 Paper 1

Multiply out the brackets and collect like terms.

$$(2y - 3)(y^2 + 4y - 1)$$

3

9. 2006 Paper 2

Factorise

$$4p^2 - 49.$$

2

## 1.5 Properties of Circles

1. 2010 Paper 2

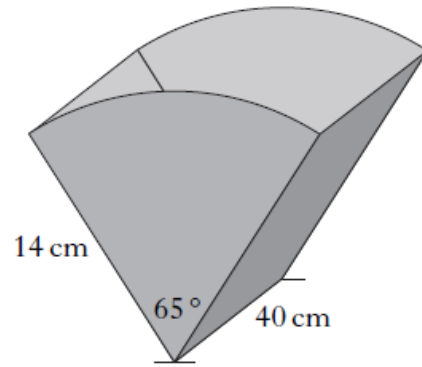
The ends of a magazine rack are identical.

Each end is a sector of a circle with radius 14 centimetres.

The angle in each sector is  $65^\circ$ .

The sectors are joined by two rectangles, each with length 40 centimetres.

The exterior is covered by material.  
What area of material is required?

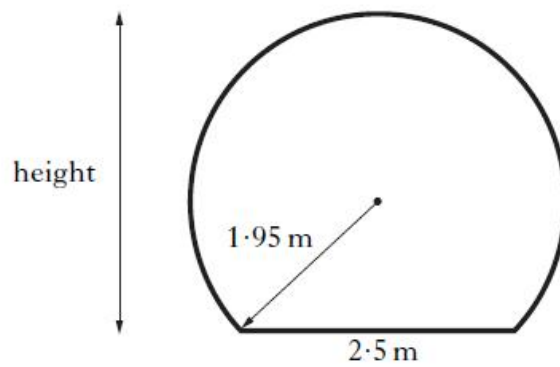


2. 2010 Paper 2

Ocean World has an underwater viewing tunnel.



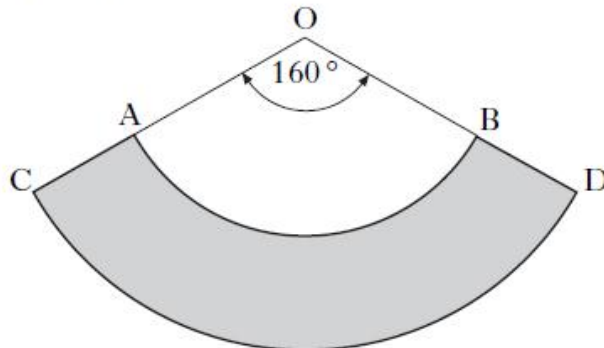
The diagram below shows the cross-section of the tunnel. It consists of part of a circle with a horizontal base.



The radius of the circle is 1.95 metres and the width of the base is 2.5 metres.  
Calculate the height of the tunnel.

3. 2009 Paper 2

A pet shop manufactures protective dog collars.  
In the diagram below the shaded area represents one of these collars.



AB and CD are arcs of the circles with centres at O.  
The radius, OA, is 10 inches and the radius, OC, is 18 inches.  
Angle AOB is  $160^\circ$ .

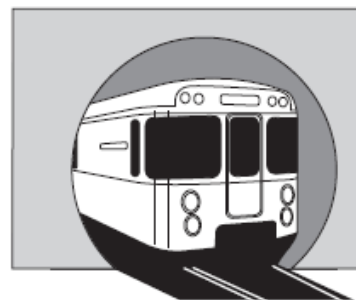
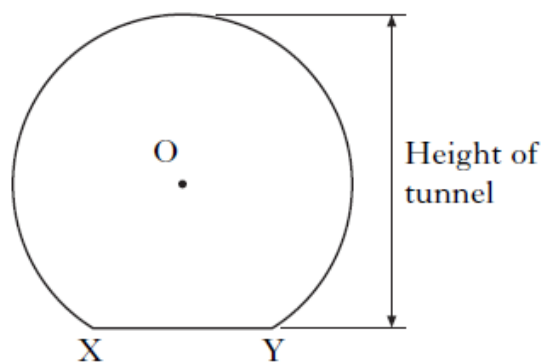
Calculate the area of a collar.

4

4. 2009 Paper 2

A railway goes through an underground tunnel.

The diagram below shows the cross-section of the tunnel. It consists of part of a circle with a horizontal base.

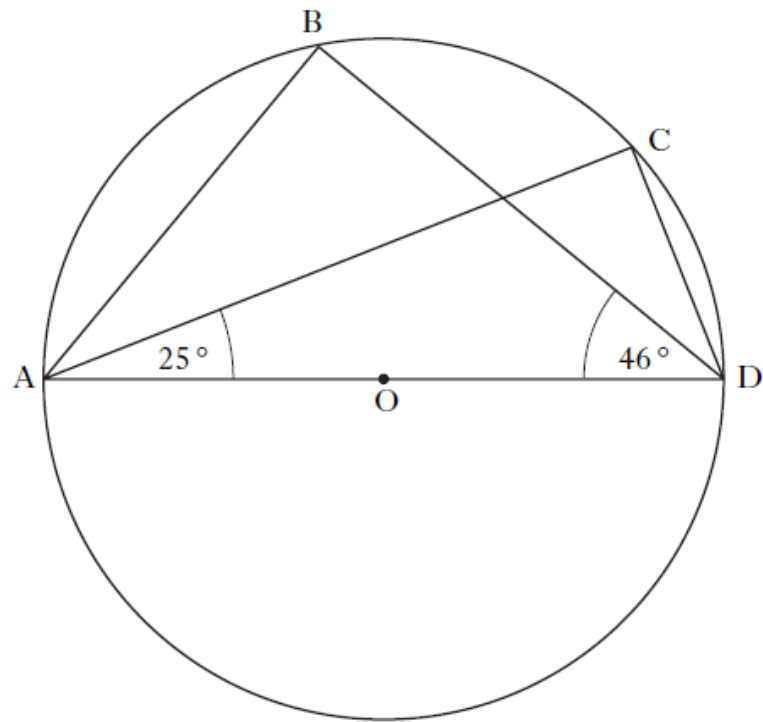


- The centre of the circle is O.
- XY is a chord of the circle.
- XY is 1.8 metres.
- The radius of the circle is 1.7 metres.

Find the height of the tunnel.

4

5. 2008 Paper 1



AD is a diameter of a circle, centre O.

B and C are points on the circumference of the circle.

Angle CAD =  $25^\circ$ .

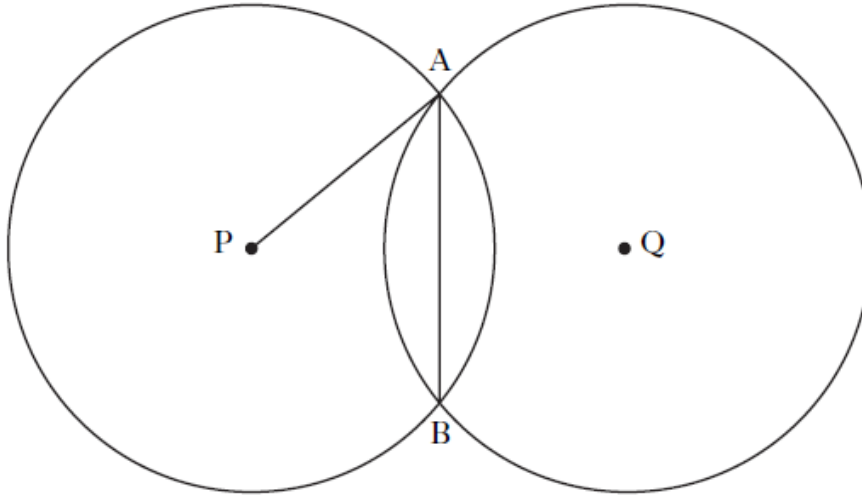
Angle BDA =  $46^\circ$ .

Calculate the size of angle BAC.

3

6. 2008 Paper 2

Two identical circles, with centres P and Q, intersect at A and B as shown in the diagram.



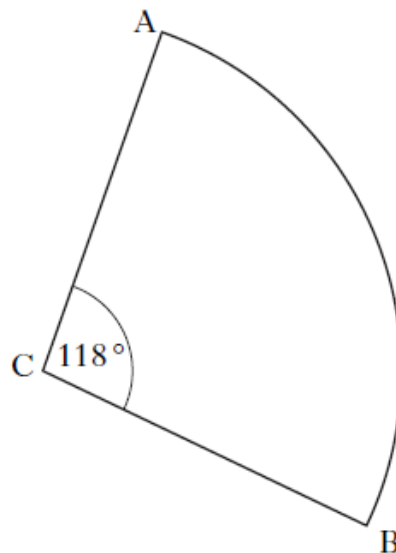
The radius of each circle is 10 centimetres.  
The length of the common chord, AB, is 12 centimetres.

Calculate PQ, the distance between the centres of the two circles.

5

7. 2007 Paper 2

The diagram below shows a sector of a circle, centre C.

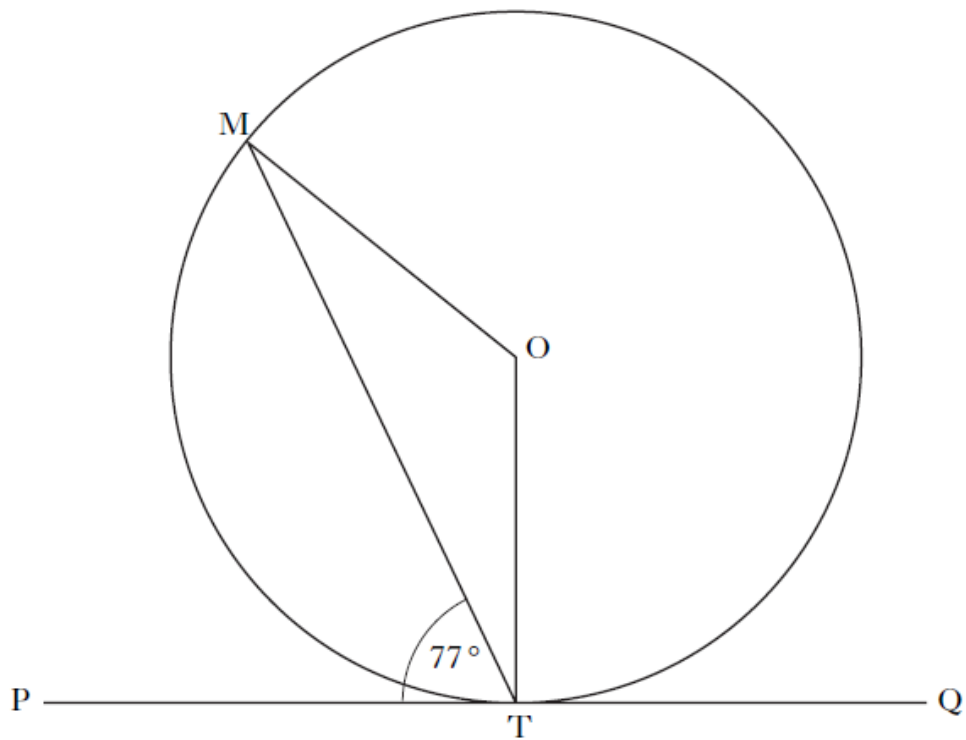


The radius of the circle is 10.5 centimetres and angle ACB is  $118^\circ$ .  
Calculate the length of arc AB.

3



8. 2007 Paper 2

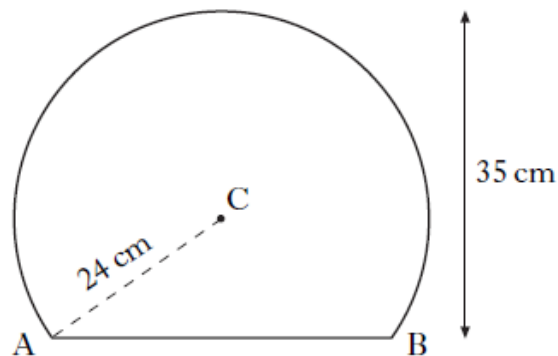


The tangent PQ touches the circle, centre O, at T.  
Angle MTP is  $77^\circ$ .

- (a) Calculate the size of angle MOT. 2
- (b) The radius of the circle is 8 centimetres.  
Calculate the length of chord MT. 3

9. 2007 Paper 2

A mirror is shaped like part of a circle.



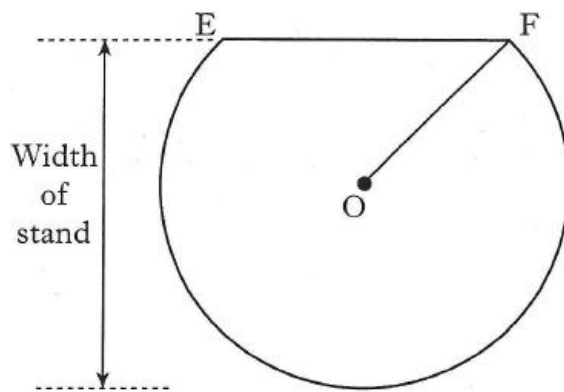
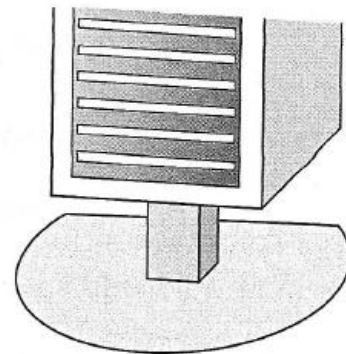
The radius of the circle, centre C, is 24 centimetres.  
The height of the mirror is 35 centimetres.

Calculate the length of the base of the mirror, represented in the diagram by AB.

3

10. 2006 Paper 2

- The diagram shows the base of a compact disc stand which has the shape of part of a circle.



- The centre of the circle is O.
- EF is a chord of the circle.
- EF is 18 centimetres.
- The radius, OF, of the circle is 15 centimetres.

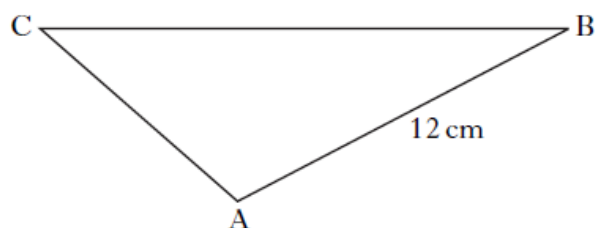
Find the width of the stand.

4



## 2.1 Trigonometry

1. 2010 Paper 1



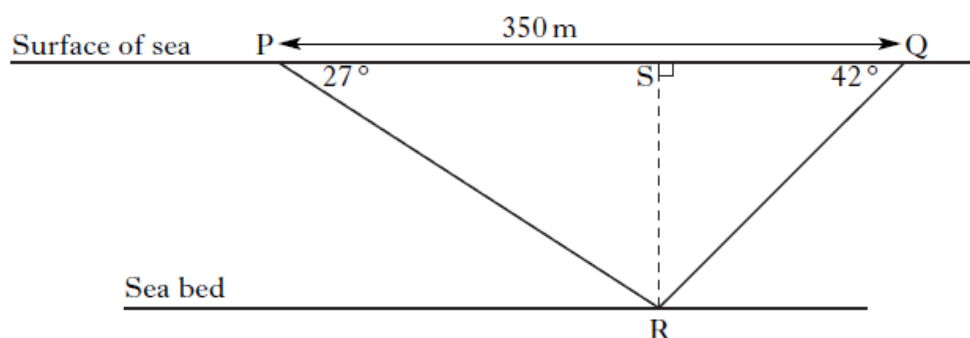
In triangle ABC,  $AB = 12$  centimetres,  $\sin C = \frac{1}{2}$  and  $\sin B = \frac{1}{3}$ .  
Find the length of side AC.

3

2. 2010 Paper 2

Two ships have located a wreck on the sea bed.

In the diagram below, the points P and Q represent the two ships and the point R represents the wreck.



The angle of depression of R from P is  $27^\circ$ .  
The angle of depression of R from Q is  $42^\circ$ .  
The distance PQ is 350 metres.

Calculate QS, the distance ship Q has to travel to be directly above the wreck.

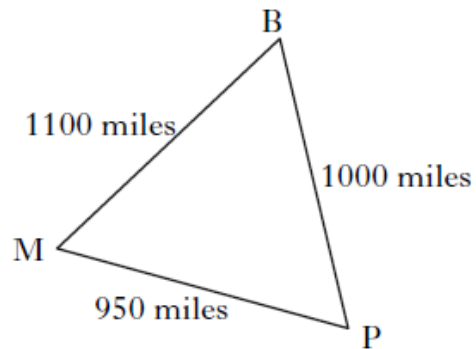
**Do not use a scale drawing.**

5

3. 2009 Paper 2

The Bermuda triangle is an area in the Atlantic Ocean where many planes and ships have mysteriously disappeared.

Its vertices are at Bermuda (B), Miami (M) and Puerto Rico (P).

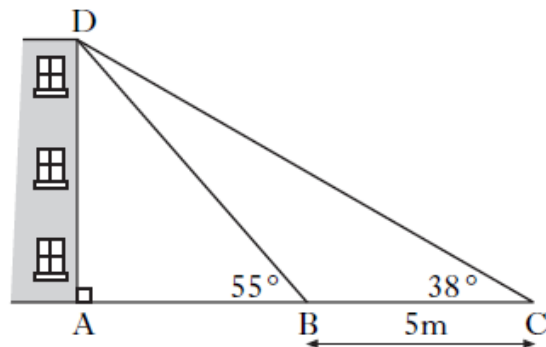


Calculate the size of angle BPM.

3

4. 2009 Paper 2

For reasons of safety, a building is supported by two wooden struts, represented by DB and DC in the diagram below.



Angle ABD =  $55^\circ$ .

Angle BCD =  $38^\circ$ .

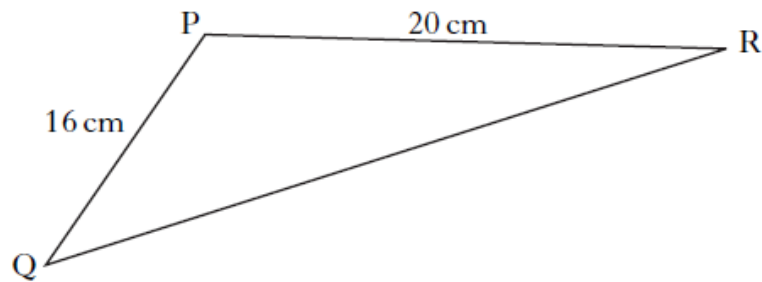
BC is 5 metres.

Calculate the height of the building represented by AD.

5

5. 2008 Paper 1

Triangle PQR is shown below.

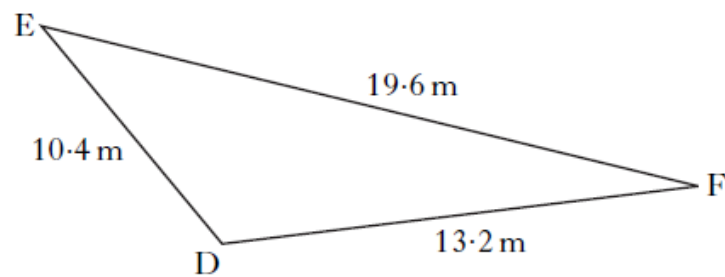


If  $\sin P = \frac{1}{4}$ , calculate the area of triangle PQR.

2

6. 2008 Paper 2

Triangle DEF is shown below.



It has sides of length 10.4 metres, 13.2 metres and 19.6 metres.

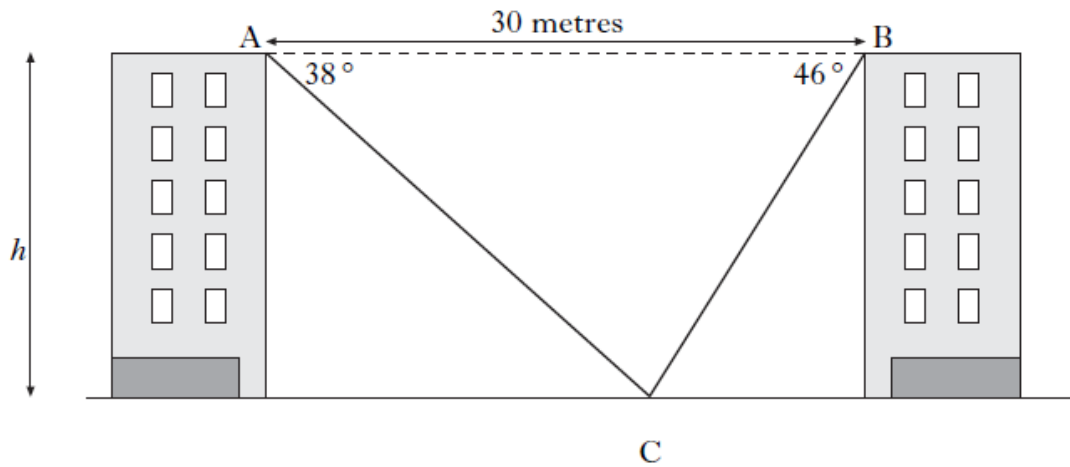
Calculate the size of angle EDF.

**Do not use a scale drawing.**

3

7. 2007 Paper 2

The diagram shows two blocks of flats of equal height.



A and B represent points on the top of the flats and C represents a point on the ground between them.

To calculate the height,  $h$ , of each block of flats, a surveyor measures the angles of depression from A and B to C.

From A, the angle of depression is  $38^\circ$ .

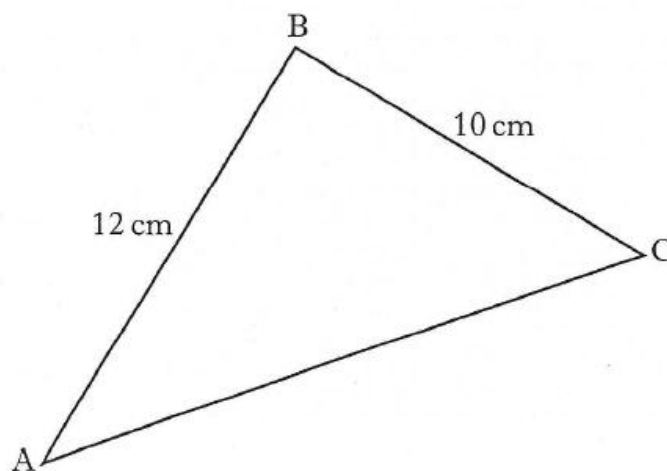
From B, the angle of depression is  $46^\circ$ .

The distance AB is 30 metres.

Calculate the height,  $h$ , in metres.

5

8. 2006 Paper 1

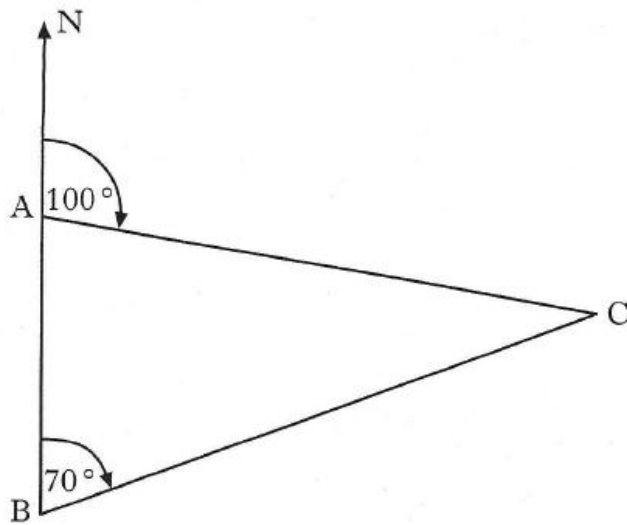


Calculate the area of triangle ABC if  $\sin B = \frac{2}{3}$ .

2

9. 2006 Paper 2

The diagram below shows the position of three campsites A, B and C.



Alan sets off from campsite A on a bearing of  $100^\circ$  at an average speed of 5.6 kilometres per hour.

At the same time Bob sets off from campsite B on a bearing of  $070^\circ$ .

**After 3 hours** they both arrive at campsite C.

Who has the faster average speed and by how much?

5



## 2.2 Simultaneous Linear Equations

### 1. 2010 Paper 2

Solve algebraically the system of equations

$$2x - 5y = 24$$

$$7x + 8y = 33.$$

3

### 2. 2009 Paper 2

There are 14 cars and 60 passengers on the morning crossing of the ferry from Wemyss Bay to Rothesay. The total takings are £344.30.

(a) Let  $x$  pounds be the cost for a car and  $y$  pounds be the cost for a passenger.

Write down an equation in  $x$  and  $y$  which satisfies the above condition.

1

(b) There are 21 cars and 40 passengers on the evening crossing of the ferry. The total takings are £368.95.

Write down a second equation in  $x$  and  $y$  which satisfies this condition.

1

(c) Find the cost for a car and the cost for a passenger on the ferry.

4

### 3. 2008 Paper 2

Suzie has a new mobile phone. She is charged  $x$  pence per minute for calls and  $y$  pence for each text she sends. During the first month her calls last a total of 280 minutes and she sends 70 texts. Her bill is £52.50.

(a) Write down an equation in  $x$  and  $y$  which satisfies the above condition.

1

The next month she reduces her bill. She restricts her calls to 210 minutes and sends 40 texts. Her bill is £38.00.

(b) Write down a second equation in  $x$  and  $y$  which satisfies this condition.

1

(c) Calculate the price per minute for a call and the price for each text sent.

4

### 4. 2007 Paper 1

Find the point of intersection of the straight lines with equations  $x + 2y = -5$  and  $3x - y = 13$ .

4

5. 2006 Paper 2

Solve algebraically the system of equations

$$4x + 2y = 13$$

$$5x + 3y = 17.$$

**3**

## 2.3 Graphs, Charts & Tables (inc. SIQR and Probability)

### 1. 2010 Paper 1

The pupils in a primary class record their shoe sizes as shown below.

8	7	6	5	6
5	7	11	7	7
7	8	7	9	6
8	6	5	9	7

- (a) Construct a frequency table from the above data and add a cumulative frequency column. 2
- (b) For this data, find:
- (i) the median; 1
  - (ii) the lower quartile; 1
  - (iii) the upper quartile. 1
- (c) Construct a boxplot for this data. 2

### 2. 2010 Paper 2

Paul conducts a survey to find the most popular school lunch.

- 30 pupils vote for Pasta
- 40 pupils vote for Baked Potato
- 2 pupils vote for Salad

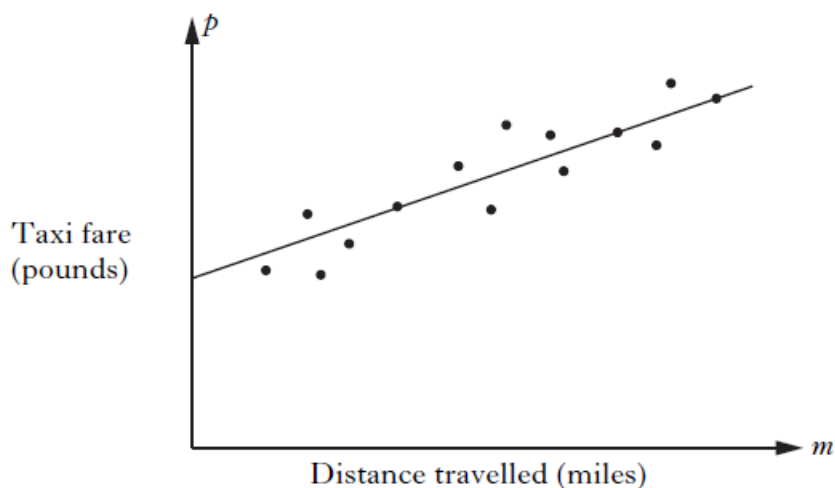
Paul wishes to draw a pie chart to illustrate his data. How many degrees must he use for each sector in his pie chart?

Do not draw the pie chart.

2

3. 2010 Paper 2

The scattergraph shows the taxi fare,  $p$  pounds, plotted against the distance travelled,  $m$  miles. A line of best fit has been drawn.



The equation of the line of best fit is  $p = 2 + 1.5m$ .

Use this equation to predict the taxi fare for a journey of 6 miles.

1

4. 2009 Paper 1

The number of goals scored one weekend by each team in the Football League is shown below.

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

(a) Construct a dotplot for the data.

2

(b) The shape of the distribution is

- A skewed to the right
- B symmetric
- C skewed to the left
- D uniform.

Write down the letter that corresponds to the correct shape.

1

5. 2009 Paper 1

(a) The marks of a group of students in their October test are listed below.

41 56 68 59 43 37 70 58 61 47 75 66

Calculate:

- (i) the median; 1  
(ii) the semi-interquartile range. 3

(b) The teacher arranges extra homework classes for the students before the next test in December.

In this test, the median is 67 and the semi-interquartile range is 7.

Make **two** appropriate comments comparing the marks in the October and December tests. 2

6. 2008 Paper 1

The stem and leaf diagram shows the number of points gained by the football teams in the Premiership League in a season.

3	3 3 3 9
4	1 4 5 5 7 8
5	0 2 3 3 6 6
6	0
7	5 9
8	
9	0

n = 20

4 | 1 represents 41 points

(a) Arsenal finished 1st in the Premiership with 90 points.

In what position did Southampton finish if they gained 47 points? 1

(b) What is the probability that a team chosen at random scored less than 44 points? 1

7. 2008 Paper 1

In a survey, the number of books carried by each girl in a group of students was recorded.

The results are shown in the frequency table below.

<i>Number of books</i>	<i>Frequency</i>
0	1
1	2
2	3
3	5
4	5
5	6
6	2
7	1

(a) Copy this frequency table and add a cumulative frequency column. 1

(b) For this data, find:

(i) the median; 1

(ii) the lower quartile; 1

(iii) the upper quartile. 1

(c) Calculate the semi-interquartile range. 1

(d) In the same survey, the number of books carried by each boy was also recorded.

The semi-interquartile range was 0.75.

Make an appropriate comment comparing the distribution of data for the girls and the boys. 1

8. 2007 Paper 1

The table below shows the results of a survey of First Year pupils.

	<i>Wearing a blazer</i>	<i>Not wearing a blazer</i>
<i>Boys</i>	40	22
<i>Girls</i>	29	9

What is the probability that a pupil, chosen at random from this sample, will be a girl wearing a blazer? 1

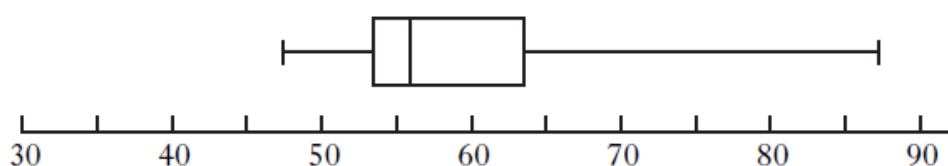
9. 2007 Paper 2

This back-to-back stem and leaf diagram shows the results for a class in a recent mathematics examination.

Girls		Boys
1	3	
9	4	7 9
8 7 4 3 2 2	5	2 3 4 4 6 6 7 9
9 4	6	3
9 6 3	7	4 8
8 1	8	7
n = 15		n = 14

Key		
3	7	represents 73%
8	7	represents 87%

(a) A boxplot is drawn to represent one set of data.



Does the boxplot above represent the girls' data or the boys' data?

**Give a reason for your answer.**

1

(b) For the **other** set of data, find:

(i) the median;

1

(ii) the lower quartile;

1

(iii) the upper quartile.

1

(c) Use the answers found in part (b) to construct a second boxplot.

2

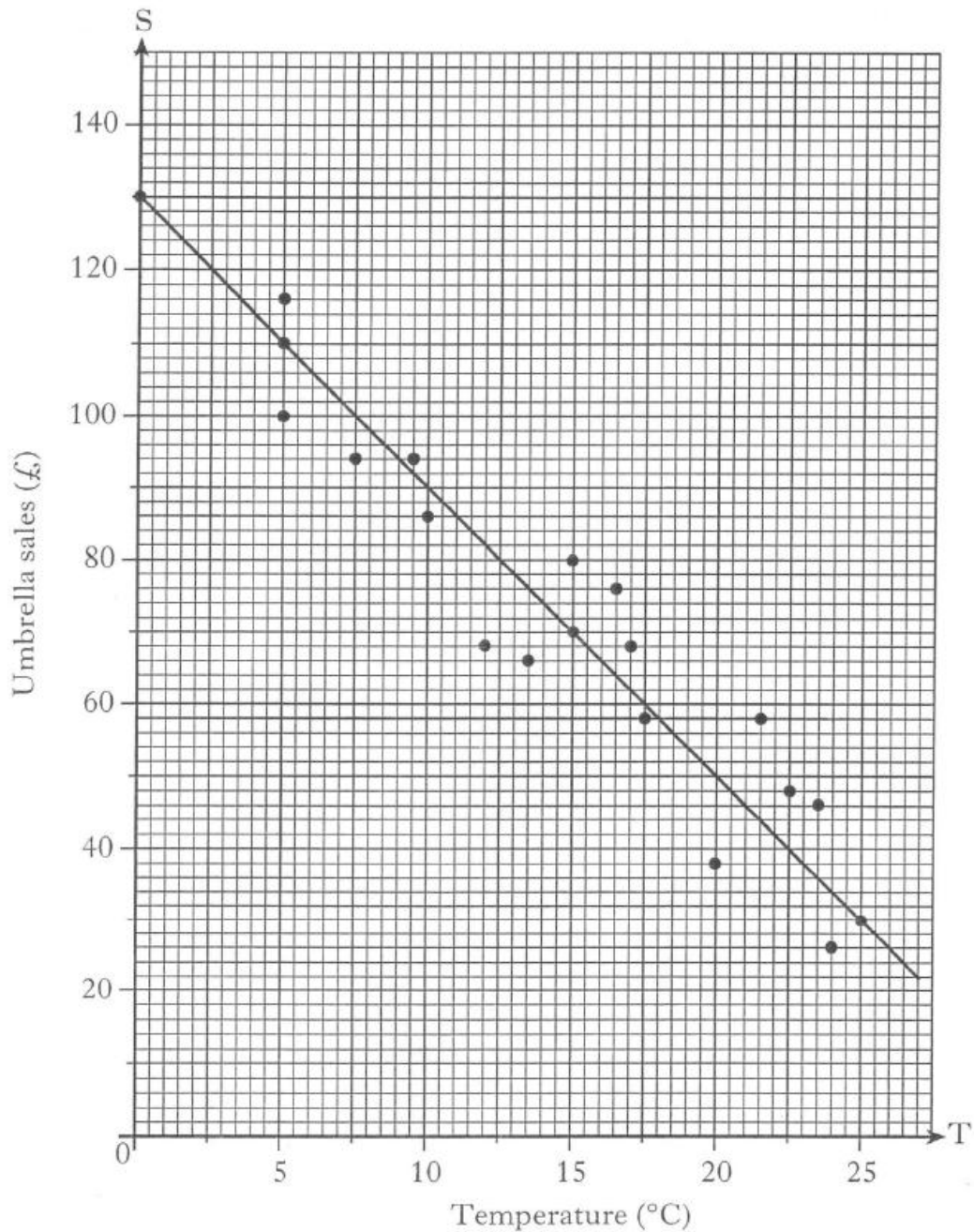
(d) Make an appropriate comment about the distribution of data in the two sets.

1

10. 2006 Paper 1

The temperature, in degrees Celsius, at mid-day in a seaside town and the sales, in pounds, of umbrellas are shown in the scattergraph below.

A line of best fit has been drawn.



(a) Find the equation of the line of best fit.

3

(b) Use your answer to part (a) to predict the sales for a day when the temperature is 30 degrees Celsius.

1



## 2.4 Simple Statistics

### 1. 2010 Paper 2

A rugby team scored the following points in a series of matches.

13    7    0    9    7    8    5

(a) For this sample, calculate:

(i) the mean; 1

(ii) the standard deviation. 3

**Show clearly all your working.**

The following season, the team appoints a new coach.

A similar series of matches produces a mean of 27 and a standard deviation of 3.25.

(b) Make two valid comparisons about the performance of the team under the new coach. 2

### 2. 2009 Paper 2

The heights, in centimetres, of seven netball players are given below.

173    176    168    166    170    180    171

For this sample, calculate:

(a) the mean; 1

(b) the standard deviation. 3

**Show clearly all your working.**

3. 2008 Paper 2

The results for a group of students who sat tests in mathematics and physics are shown below.

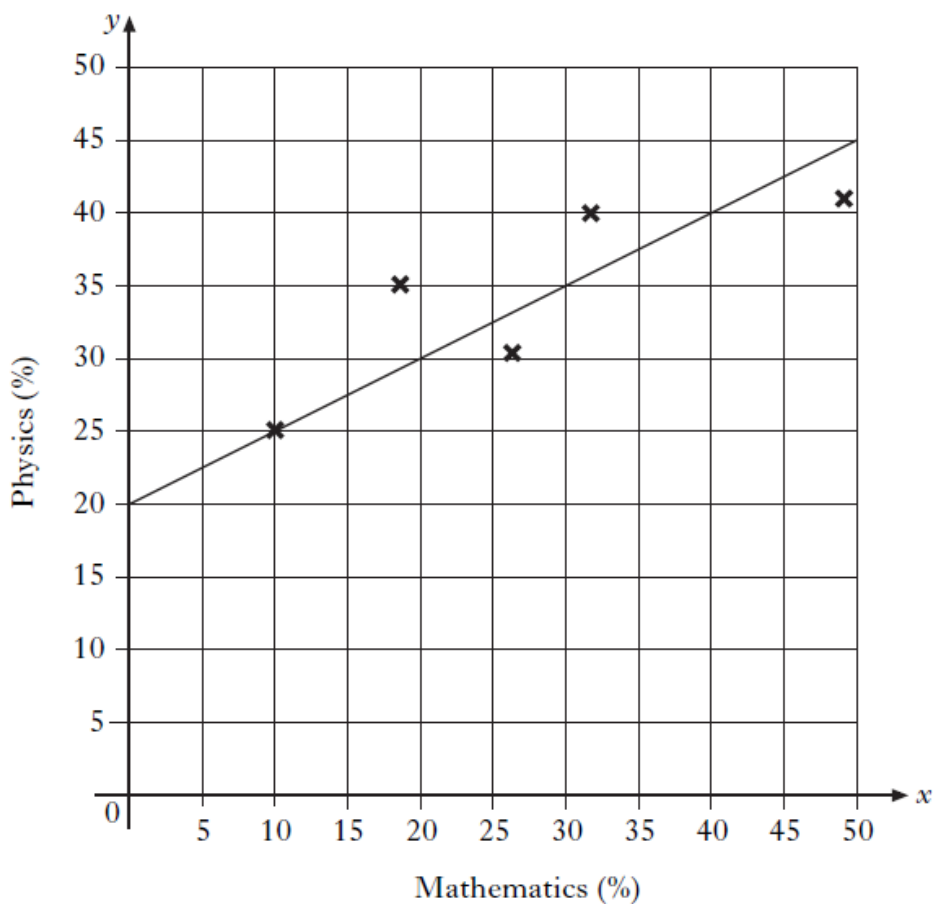
<i>Mathematics (%)</i>	10	18	26	32	49
<i>Physics (%)</i>	25	35	30	40	41

(a) Calculate the standard deviation for the mathematics test. 4

(b) The standard deviation for physics was 6.8.  
 Make an appropriate comment on the distribution of marks in the two tests. 1

These marks are shown on the scattergraph below.

A line of best fit has been drawn.



(c) Find the equation of the line of best fit. 3

(d) Another pupil scored 76% in the mathematics test but was absent from the physics test.

Use your answer to part (c) to predict his physics mark. 1

4. 2007 Paper 1

- (a) Show that the standard deviation of 1, 1, 1, 2 and 5 is equal to  $\sqrt{3}$ . 3
- (b) **Write down** the standard deviation of 101, 101, 101, 102 and 105. 1

4. 2007 Paper 2

Tasnim rolls a standard dice with faces numbered 1 to 6.

The probability that she gets a number less than 7 is

- A 0  
B  $\frac{1}{7}$   
C  $\frac{1}{6}$   
D 1.

Write down the letter that corresponds to the correct probability. 1

5. 2006 Paper 1

In a factory, the number of workers absent each day is recorded for 21 days.

The results are listed below.

19	22	19	22	20	21	17
19	21	16	20	19	18	18
20	20	23	19	18	17	19

- (a) Construct a dotplot for this data. 2
- (b) Find:
- (i) the median; 1
  - (ii) the lower quartile; 1
  - (iii) the upper quartile. 1
- (c) What is the probability that, on a day chosen at random from this sample, more than 18 workers were absent? 1

6. 2006 Paper 2

A new central heating system is installed in a house.

Sample temperatures, in degrees Celsius, are recorded below.

19    21    23    21    19    20

(a) For this sample data, calculate:

(i) the mean;

1

(ii) the standard deviation.

3

**Show clearly all your working.**

The target temperature for this house is  $20^{\circ}\text{Celsius}$ . The system is judged to be operating effectively if the mean temperature is within  $0.6^{\circ}\text{Celsius}$  of the target temperature **and** the standard deviation is less than  $2^{\circ}\text{Celsius}$ .

(b) Is the system operating effectively?

**Give reasons for your answer.**

2

### 3.1 Algebraic Operations

1. 2010 Paper 1

Express

$$p^3(p^2 - p^{-3})$$

in its simplest form.

2

2. 2010 Paper 2

Express

$$\frac{s^2}{t} \times \frac{3t}{2s}$$

as a fraction in its simplest form.

2

3. 2010 Paper 2

Change the subject of the formula

$$P = 2(L + B)$$

to  $L$ .

2

4. 2010 Paper 2

Express

$$\sqrt{63} + \sqrt{28} - \sqrt{7}$$

as a surd in its simplest form.

3

5. 2009 Paper 2

Express

$$\frac{2}{x-1} + \frac{4}{x+2} \quad x \neq 1, x \neq -2$$

as a single fraction in its simplest form.

3

6. 2009 Paper 2

Change the subject of the formula

$$A = \frac{1}{2}h(a + b)$$

to  $h$ .

2

7. 2009 Paper 2

Express  $\frac{12}{\sqrt{2}}$  with a rational denominator.

Give your answer in its simplest form.

2

8. 2009 Paper 2

Simplify  $\frac{ab^6}{a^3b^2}$ .

2

9. 2008 Paper 1

(a) Simplify

$$\frac{m^5}{m^3}$$

1

(b) Express

$$2\sqrt{5} + \sqrt{20} - \sqrt{45}$$

as a surd in its simplest form.

3

10. 2008 Paper 2

Change the subject of the formula

$$p = q + \sqrt{a}$$

to  $a$ .

2

11. 2008 Paper 2

Express

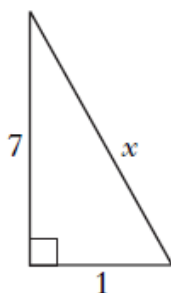
$$\frac{2}{a} - \frac{3}{(a+4)}, \quad a \neq 0, a \neq -4,$$

as a single fraction in its simplest form.

3

12. 2007 Paper 1

A right-angled triangle is shown below.



Using Pythagoras' Theorem, find  $x$ .

Express your answer as a surd in its simplest form.

3

13. 2007 Paper 2

Express  $\frac{5p^2}{8} \div \frac{p}{2}$  as a fraction in its simplest form.

3

14. 2007 Paper 2

Change the subject of the formula

$$K = \frac{m^2 n}{p}$$

to  $m$ .

3

15. 2007 Paper 2

Simplify the expression below, giving your answer with a positive power.

$$m^5 \times m^{-8}$$

2

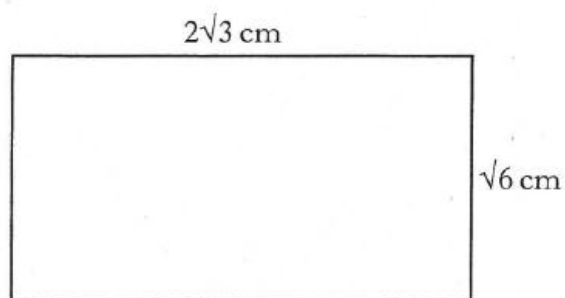
16. 2006 Paper 1

Evaluate

$$16^{\frac{3}{4}}$$

2

17. 2006 Paper 1



The rectangle above has length  $2\sqrt{3}$  centimetres and breadth  $\sqrt{6}$  centimetres.  
Calculate the area of the rectangle.

Express your answer as a surd in its simplest form.

3

18. 2006 Paper 2

Express

$$\frac{3}{(x+1)} - \frac{1}{(x-2)}, \quad x \neq -1, \quad x \neq 2$$

as a single fraction in its simplest form.

3

19. 2006 Paper 2

Change the subject of the formula

$$\frac{x}{c} + a = b$$

to  $x$ .

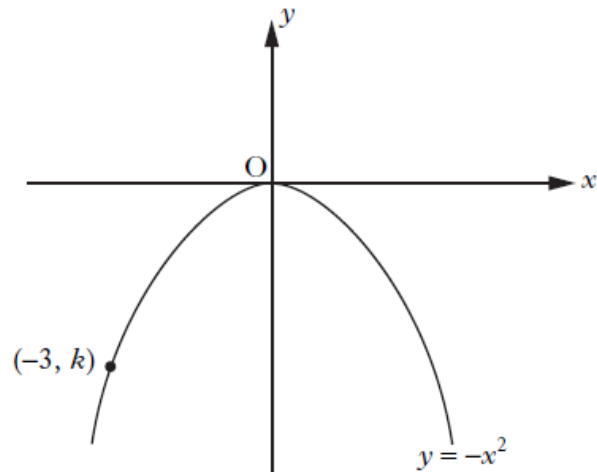
2



### 3.2 Quadratic Functions

#### 1. 2010 Paper 1

The diagram below shows the graph of  $y = -x^2$ .



The point  $(-3, k)$  lies on the graph.

Find the value of  $k$ .

1

#### 2. 2010 Paper 1

Maria has been asked to find the roots of the equation

$$x^2 + 3x + 5 = 0.$$

She decides to use the quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

(a) Calculate the value of  $b^2 - 4ac$ .

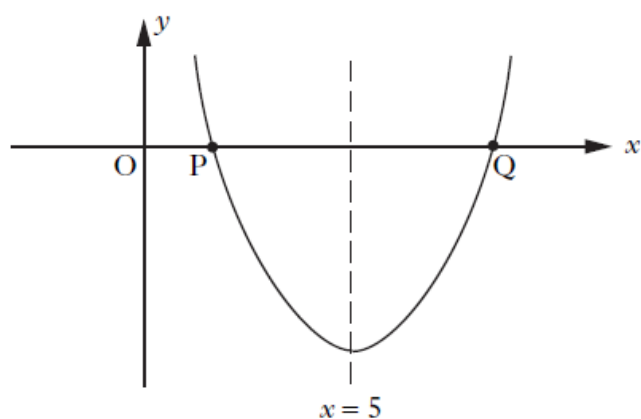
1

(b) Now explain why Maria cannot find the roots.

1

3. 2010 Paper 1

The graph below shows part of a parabola with equation of the form  $y = (x + a)^2 + b$ .

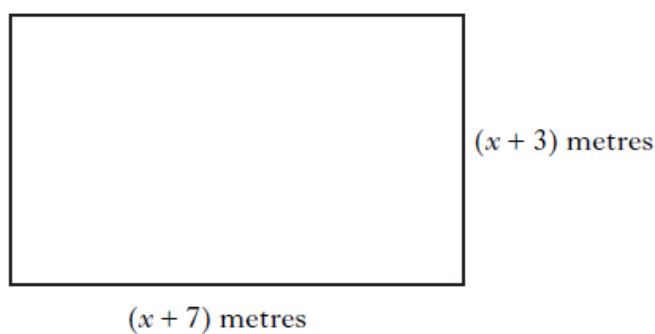


The equation of the axis of symmetry of the parabola is  $x = 5$ .

- (a) State the value of  $a$ . 1
- (b) P is the point  $(2, 0)$ . State the coordinates of Q. 1
- (c) Calculate the value of  $b$ . 2

4. 2010 Paper 2

The diagram below represents a rectangular garden with length  $(x + 7)$  metres and breadth  $(x + 3)$  metres.



- (a) Show that the area,  $A$  square metres, of the garden is given by

$$A = x^2 + 10x + 21. \quad 2$$

- (b) The area of the garden is 45 square metres. Find  $x$ .

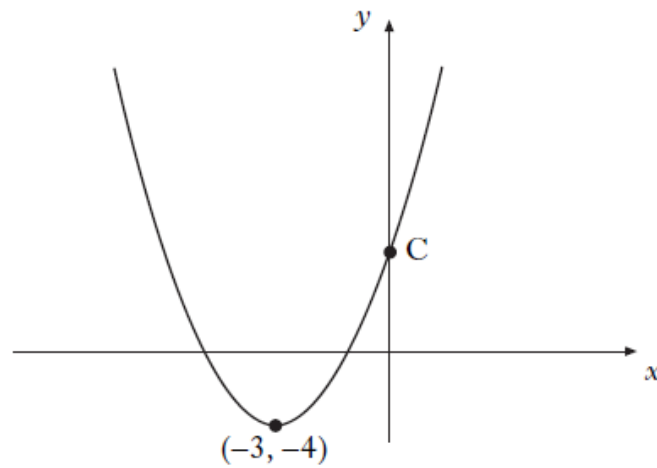
**Show clearly all your working.**

4

5. 2009 Paper 1

The diagram below shows part of a parabola with equation of the form

$$y = (x + a)^2 + b.$$



- (a) Write down the equation of the axis of symmetry of the graph. 1
- (b) Write down the equation of the parabola. 2
- (c) Find the coordinates of C. 2

6. 2009 Paper 2

Solve the equation

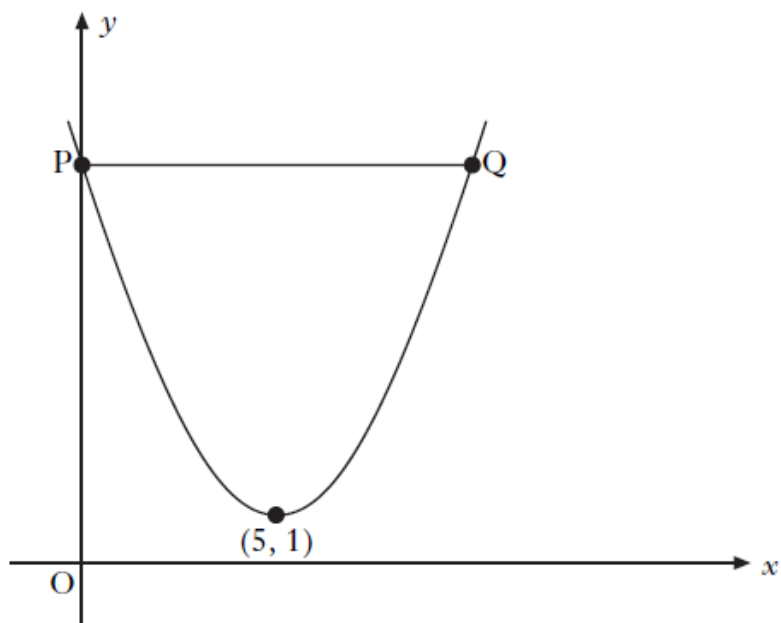
$$x^2 + 5x + 3 = 0,$$

giving the roots correct to one decimal place. 4

7. 2008 Paper 1

The graph below shows part of a parabola with equation of the form

$$y = (x + a)^2 + b.$$



- (a) State the values of  $a$  and  $b$ . 2
- (b) State the equation of the axis of symmetry of the parabola. 1
- (c) The line PQ is parallel to the  $x$ -axis.  
Find the coordinates of points P and Q. 3

7. 2008 Paper 2

Solve the equation

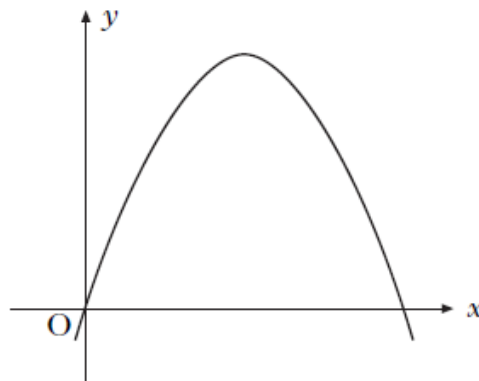
$$5x^2 + 4x - 2 = 0,$$

giving the roots correct to 2 decimal places.

4

8. 2007 Paper 1

The graph shown below is part of the parabola with equation  $y = 8x - x^2$ .



(a) By factorising  $8x - x^2$ , find the roots of the equation

$$8x - x^2 = 0.$$

2

(b) State the equation of the axis of symmetry of the parabola.

1

(c) Find the coordinates of the turning point.

2

9. 2007 Paper 2

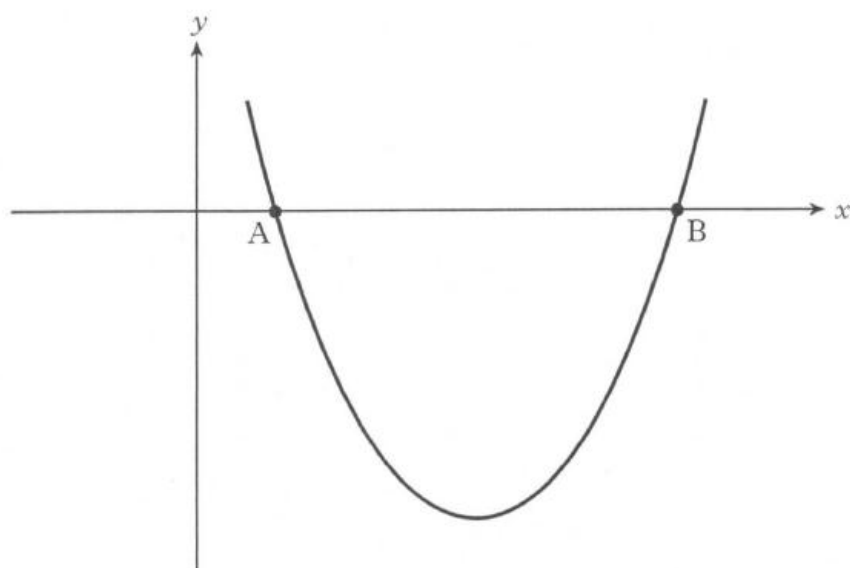
Solve the equation

$$2x^2 - 6x - 5 = 0,$$

giving the roots correct to one decimal place.

4

10. 2006 Paper 1



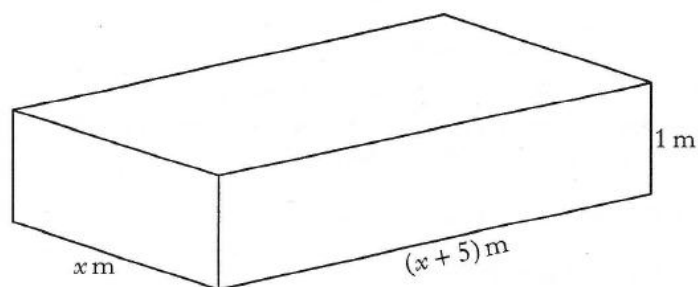
The equation of the parabola in the above diagram is

$$y = (x - 3)^2 - 4.$$

- (a) State the coordinates of the minimum turning point of the parabola. 2
- (b) State the equation of the axis of symmetry of the parabola. 1
- (c) A is the point (1, 0). State the coordinates of B. 1

11. 2006 Paper 2

A cuboid is shown below.



It has length  $(x + 5)$  metres, breadth  $x$  metres, height 1 metre and volume 24 cubic metres.

- (a) Show that

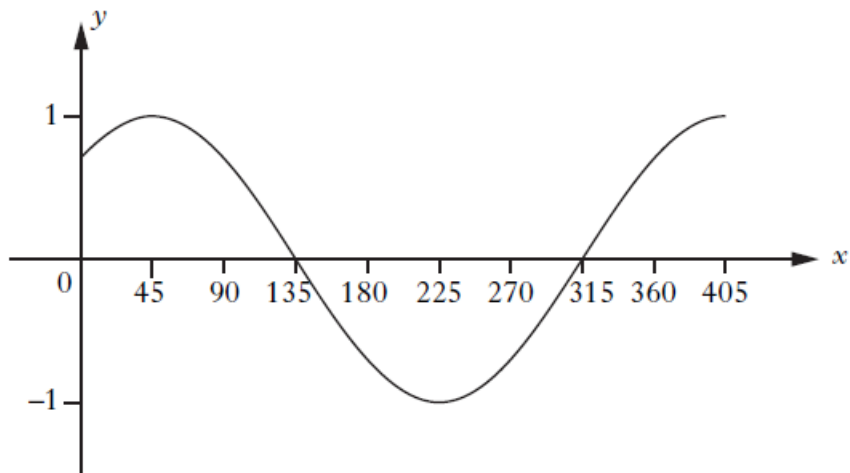
$$x^2 + 5x - 24 = 0. \quad 2$$

- (b) Using the equation in part (a), find the breadth of the cuboid. 3

### 3.3 Further Trigonometry

1. 2010 Paper 1

The graph shown below has an equation of the form  $y = \cos(x - a)^\circ$ .



Write down the value of  $a$ .

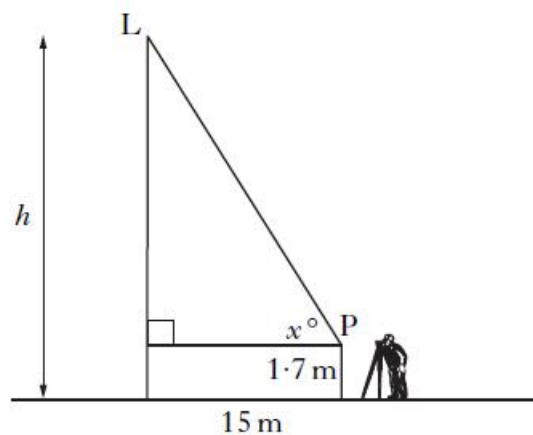
1

2. 2010 Paper 2

A surveyor views a lift as it travels up the outside of a building.



In the diagram below, the point L represents the lift.



The height,  $h$  metres, of the lift above the ground is given by the formula

$$h = 15 \tan x^\circ + 1.7,$$

where  $x^\circ$  is the angle of elevation of the lift from the surveyor at point P.

- (a) What is the height of the lift above the ground when the angle of elevation from P is  $25^\circ$ ? 2
- (b) What is the angle of elevation at point P when the height of the lift above the ground is 18.4 metres? 3

3. 2009 Paper 1

An angle,  $a^\circ$ , can be described by the following statements.

- $a$  is greater than 0 and less than 360
- $\sin a^\circ$  is negative
- $\cos a^\circ$  is positive
- $\tan a^\circ$  is negative

Write down a possible value for  $a$ .

1



4. 2009 Paper 1

Sketch the graph of  $y = 4 \cos 2x^\circ$ ,  $0 \leq x \leq 360$ .

3

5. 2009 Paper 1

Simplify

$$\frac{\cos^3 x^\circ}{1 - \sin^2 x^\circ}$$

2

6. 2009 Paper 2

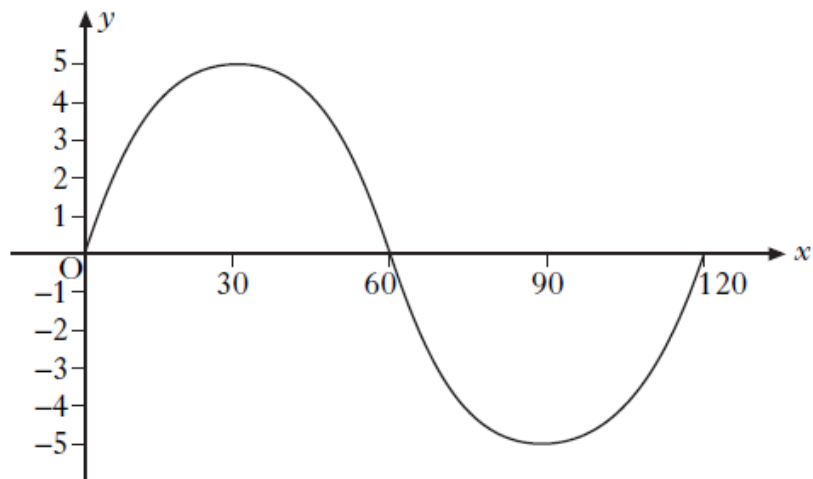
Solve the equation

$$7 \sin x^\circ + 1 = -5, \quad 0 \leq x \leq 360.$$

3

7. 2008 Paper 1

Part of the graph of  $y = a \sin bx^\circ$  is shown in the diagram.



State the values of  $a$  and  $b$ .

2

8. 2008 Paper 2

If  $\sin x^\circ = \frac{4}{5}$  and  $\cos x^\circ = \frac{3}{5}$ , calculate the value of  $\tan x^\circ$ .

2

9. 2008 Paper 2

Solve the equation

$$4 \cos x^\circ + 3 = 0, \quad 0 \leq x \leq 360.$$

3

10. 2007 Paper 1

Given that

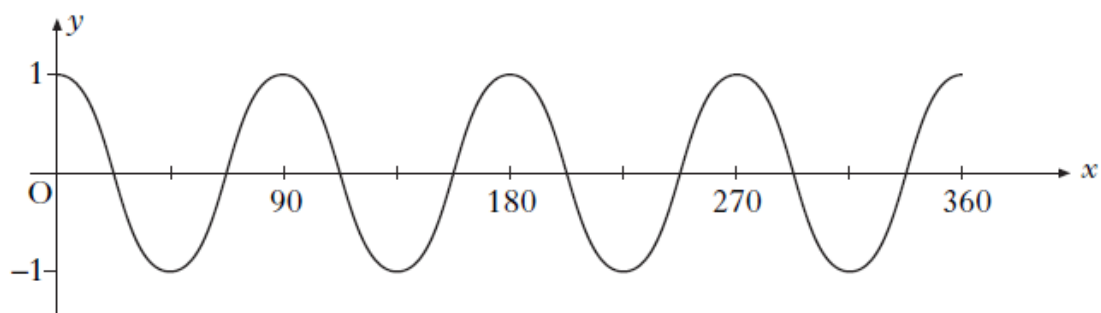
$$\cos 60^\circ = 0.5,$$

what is the value of  $\cos 240^\circ$ ?

1

11. 2007 Paper 1

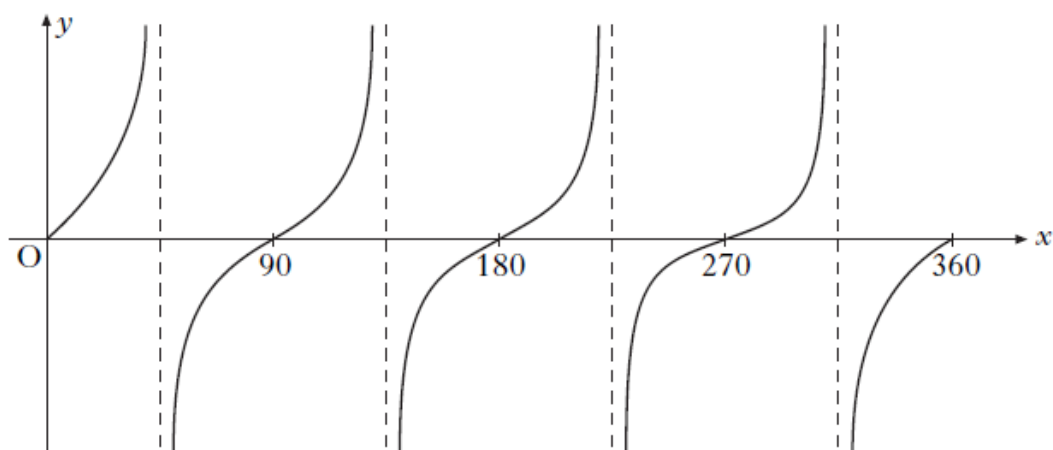
(a) Part of the graph of  $y = \cos ax^\circ$  is shown below.



State the value of  $a$ .

1

(b) Part of the graph of  $y = \tan bx^\circ$  is shown below.



State the value of  $b$ .

1

12. 2007 Paper 2

Solve the equation

$$5 \tan x^\circ - 6 = 2, \quad 0 \leq x < 360. \quad 3$$

13. 2006 Paper 1

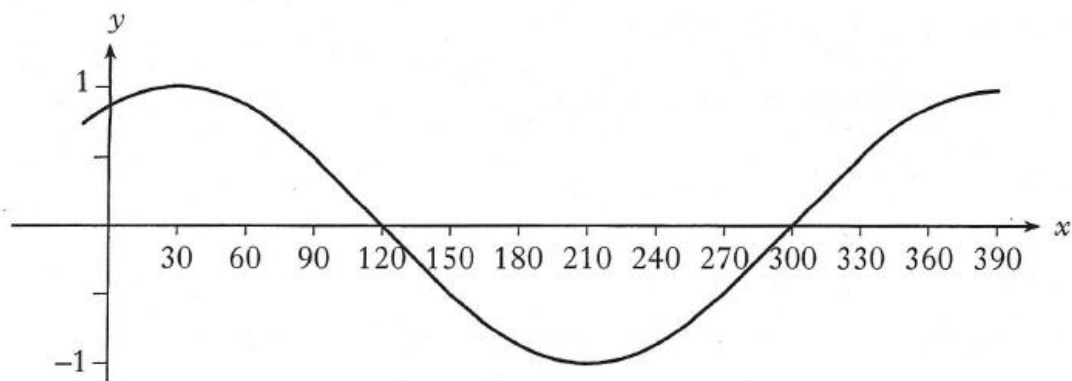
Write the following in order of size, **starting with the smallest**.

$$\sin 0^\circ \quad \sin 30^\circ \quad \sin 200^\circ$$

Give a reason for your answer. 2

14. 2006 Paper 1

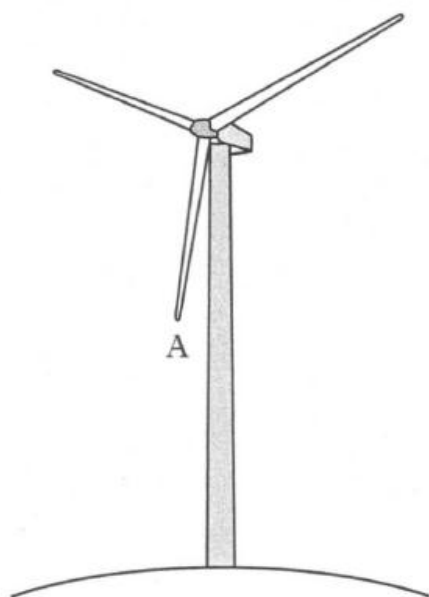
The graph shown below has an equation of the form  $y = \cos(x - a)^\circ$ .



Write down the value of  $a$ . 1

15. 2006 Paper 2

The arms on a wind turbine rotate at a steady rate.



The height,  $h$  metres, of a point A above the ground at time  $t$  seconds is given by the equation

$$h = 8 + 4 \sin t^\circ.$$

- (a) Calculate the height of point A at time 30 seconds. 2
- (b) Find the **two** times during the first turn of the arms when point A is at a height of 10.5 metres. 4