Mathematical Formulae

Compound interest

$$\text{Total amount} = P\left(1+\frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

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

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

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

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

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

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f}$$

$$\text{Standard deviation} = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$$

PAPER 1

Answer **all** the questions.

1. (a) Evaluate $\dfrac{46.02 - 1.5}{2.65 \times 4}$.

Answer (a) ..…….…… [1]

(b) The circumference of the Moon is 10917 km.

Write 10917 to the nearest thousand.

Answer (b) ..…….…… [1]

---

2. Audrian leaves home at 6.45 am and travels to school at an average speed of 18 km/h.

He arrives in school at 7.10 am.

How far is it from Audrian's home to his school?

Answer …….……km [2]

---

3. Solve $(3x + 2)(x - 4) = 0$.

Answer x = ……..…… [2]

---

4. The price of a LED TV is $ 900.

Anne decides to pay by hire-purchase.

She pays a 20% deposit and then a monthly instalment of $36 for 2.5 years.

How much does she pay in total?

Answer $ ...…….…… [2]

---

5. (a) Find the smallest number that is divisible by both 16 and 56.

Answer (a) ..……..…… [1]

(b) The cube root of n is $3^2 \times 4$.

Find n as the product of its prime factors.

Answer (b) ..……..…… [1]

---

6. A group of 6 girls has a mean weight of 52 kg.

When Jayce joins the group the mean weight is then 50.5 kg.

Find Jayce's weight.

Answer … ……..….... kg [2]

---

7. A sphere has a radius of $3x$ centimetres and a surface area of 32 cm^2.
Find x in terms of π.

Answer $x =$ ……..…… [2]

---

8. Airbus A320 can carry p passengers and 15 crew members.

(a) Write an expression for the maximum number of people that can be carried on n Airbus A320.

Answer (a) ..……..…… [1]

(b) Given that $p = 135$, find the least number of Airbus A320 required to carry 700 people.

Answer (b) ..……..…… [2]

---

9. (a) Simplify $\frac{(2n)^3}{4} \div \frac{3n}{8}$.

Answer (a) ..…….…… [2]

(b) Expand and simplify $4(1-3x)-3(x-2)$.

Answer (b) ..…….…… [2]

---

10. (a) Write these numbers in order of size, starting with the smallest.

3^0 $9^{\frac{2}{3}}$ $27^{-\frac{1}{3}}$ $81^{\frac{1}{2}}$

Answer (a) ……, ……, ……, …… [1]

(b) Given that $8^3 \times 16^{\frac{1}{2}} = 4^x$, find *x*.

Answer (b) *x* = ……..…… [2]

---

11. (a) Solve the inequality $5x + 2 \leq 17$.

Answer (a) ..…….…… [1]

(b) Solve $\frac{p+4}{p-3} = 2$.

Answer (b) p = ……..…… [2]

---

12. It is given that a map of Singapore has a scale of 1 : 50000.

(a) The distance on the map between Yishun MRT station and Dhoby Ghaut MRT station is 38 cm.

Find the actual distance, in kilometres, between the two stations.

Answer (a) ..…….…… km [1]

(b) The area of Yishun Town is 8 km^2.

What is the area of Yishun Town, in square centimetres, on the map?

Answer (b) ……..…… cm^2 [2]

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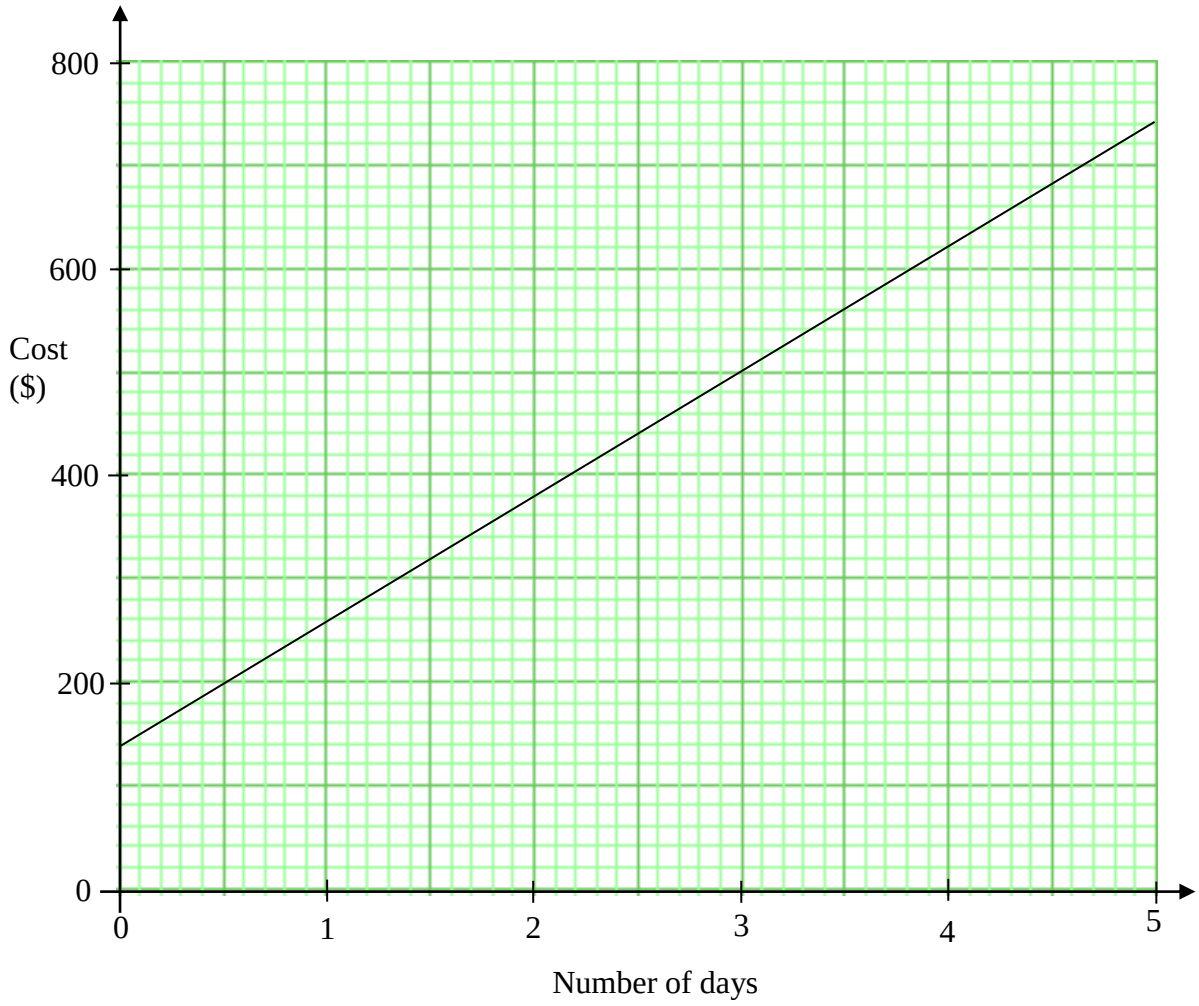
13. The graph shows the cost charged by a photographer.



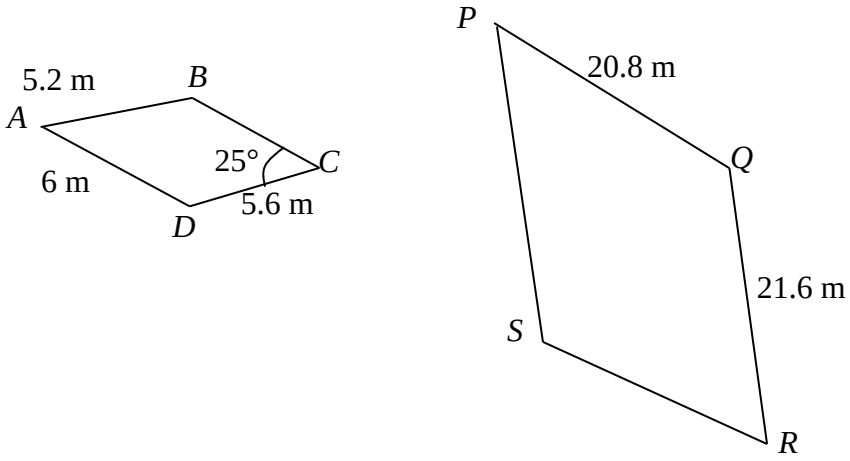
(a) How much does it cost to hire the photographer for 4 days?

Answer (a) $ ……..…… [1]

(b) The photographer charges a basic fee $$x$ plus $$y$ per day.
Find x and y.

Answer (b) x = ……..….
y = ……..... [2]

14.



Quadrilateral *PQRS* is an enlargement of quadrilateral *ABCD*.

$\angle BCD = 25°$, $AB = 5.2$ m, $CD = 5.6$ m, AD is 6 m, $PQ = 20.8$ m and $QR = 21.6$ m.

Find

(a) the scale factor,

Answer (a) ..…….…… [1]

(b) *RS*,

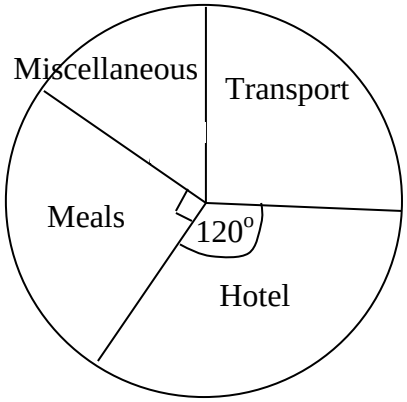
Answer (b) RS = ……..…… m [1]

(c) the reflex angle *QRS*.

Answer (c) reflex $\angle QRS$ = ...…..... ° [1]

15. Helmi spent $3240 on a holiday.

The pie chart represents the expenses for the holiday.



(a) How much did he spend altogether on his hotel and meals?

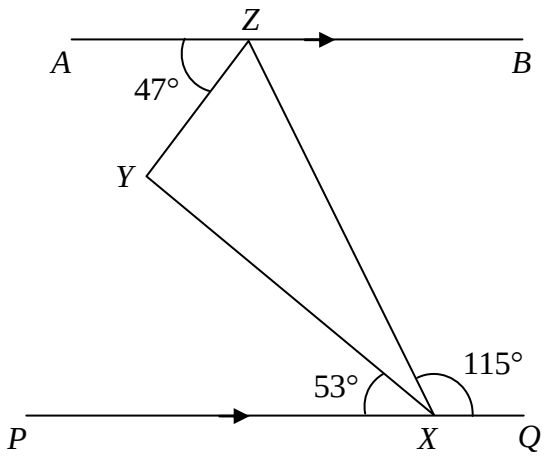
Answer (a) $ ……..…… [1]

(b) Miscellaneous expenses were half of the cost of his transport.

Calculate Helmi's expenses on transport.

Answer (b) $ ……..…… [2]

16. In the figure below, AB is parallel to PQ, $\angle AZY = 47°$, $\angle PXY = 53°$ and $\angle QXZ = 115°$.



Find the value of

(a) $\angle BZX$,

Answer (a) $\angle BZX$ = ……..…… [1]

(b) $\angle XYZ$.

Answer (b) $\angle XYZ$ = ……..…… [1]

17. (a) Simplify $\frac{3x}{4} - \frac{2(x-1)}{5}$.

Answer (a) ..…….…… [2]

(b) Factorise $4y^2 + 4y - 15$.

Answer (b) ..…….…… [2]

---

18. (a) By completing the square, $x^2 - 8x + 11$ can be expressed in the form $(x+p)^2 + q$.
Find p and q.

Answer (a) p = ……..….
q = ……..... [2]

(b) Hence, or otherwise, solve $x^2 - 8x + 11 = 0$.
Give your answers correct to 2 decimal places.

Answer (b) x = …… or …… [2]

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19. The diagram below shows a pattern sequence formed by using marbles.

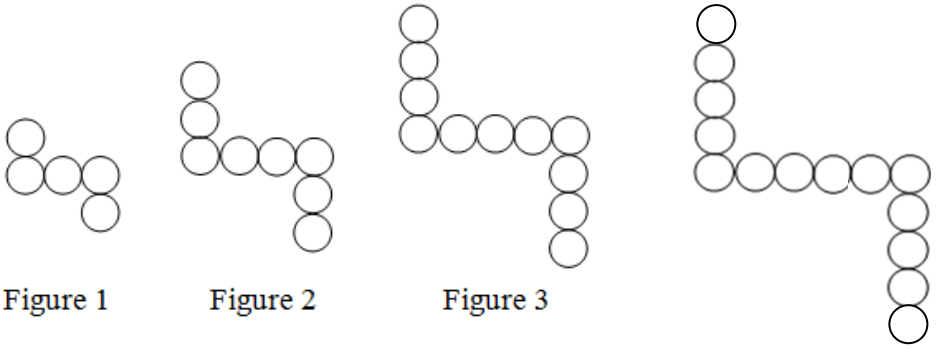


Figure 1 Figure 2 Figure 3 Figure 4

(a) Complete the table.

Pattern Number	1	2	3	4	5
Number of marbles	5	8	11	14	

[1]

(b) Which pattern would have 32 marbles?

Answer (b) Pattern ..…….…… [1]

(c) Write down an expression, in terms of n, for the number of marbles in Pattern n.

Answer (c) ..…….…… [1]

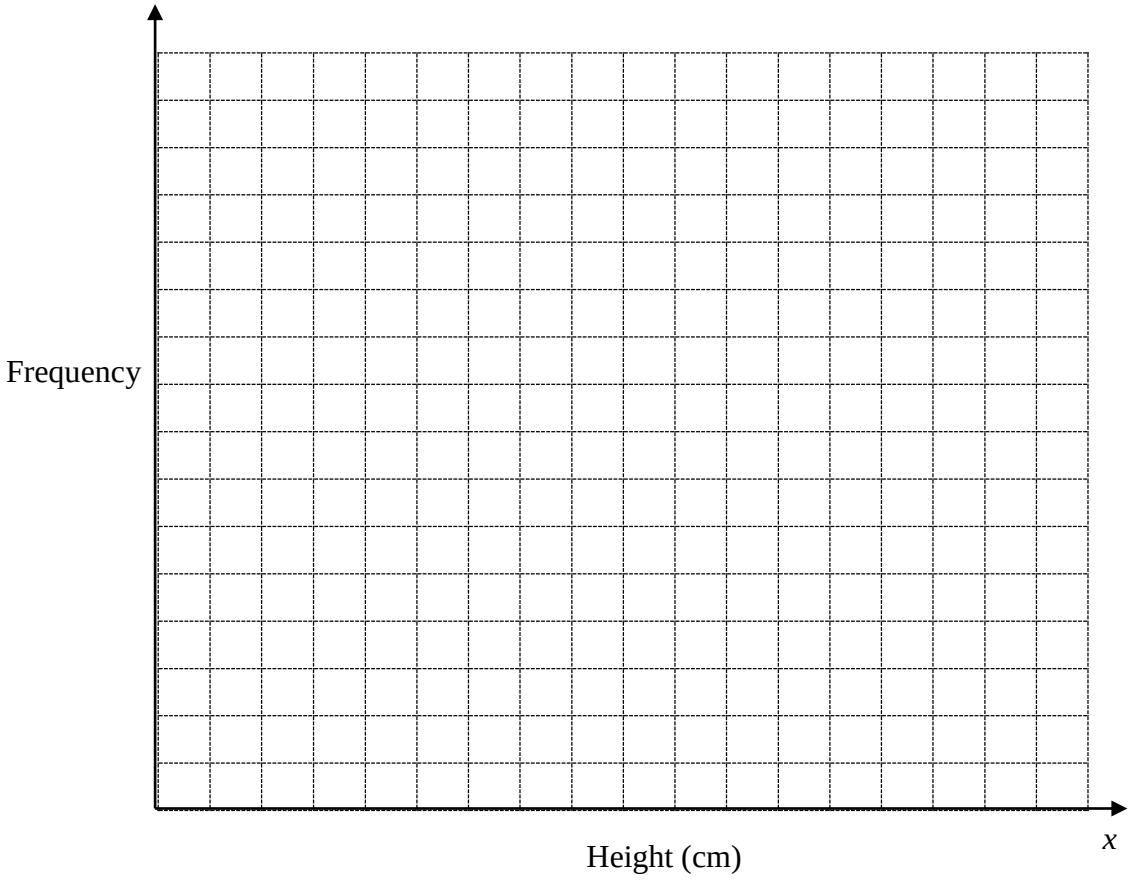
(d) How many marbles would there be in Pattern 75?

Answer (d) ..…….…… [1]

20. The table below shows the distribution of the heights of 100 books.

Height, x (cm)	Number of books
$0 < x \leq 10$	15
$10 < x \leq 20$	40
$20 < x \leq 30$	20
$30 < x \leq 40$	25

(a) On the grid, draw a histogram to represent this information.



[2]

(b) Find the probability that one of these books, chosen at random, is taller than 20 cm.
Give your answer as a fraction in its simplest form.

Answer (b) ……..…… [1]

(c) A book has a height of 10 cm.
In which height interval from the frequency table would this height be placed?

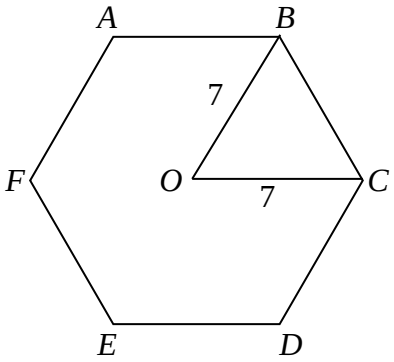
Answer (c) …… $< x \leq$ …… [1]

21. (a) The interior angle of a regular polygon is 162°.

How many sides has the polygon?

Answer (a) ……..…… [2]

(b)



ABCDEF is a regular hexagon, centre *O*.

The distance from the centre of the hexagon to each vertex is 7 cm.

Calculate the area of the hexagon.

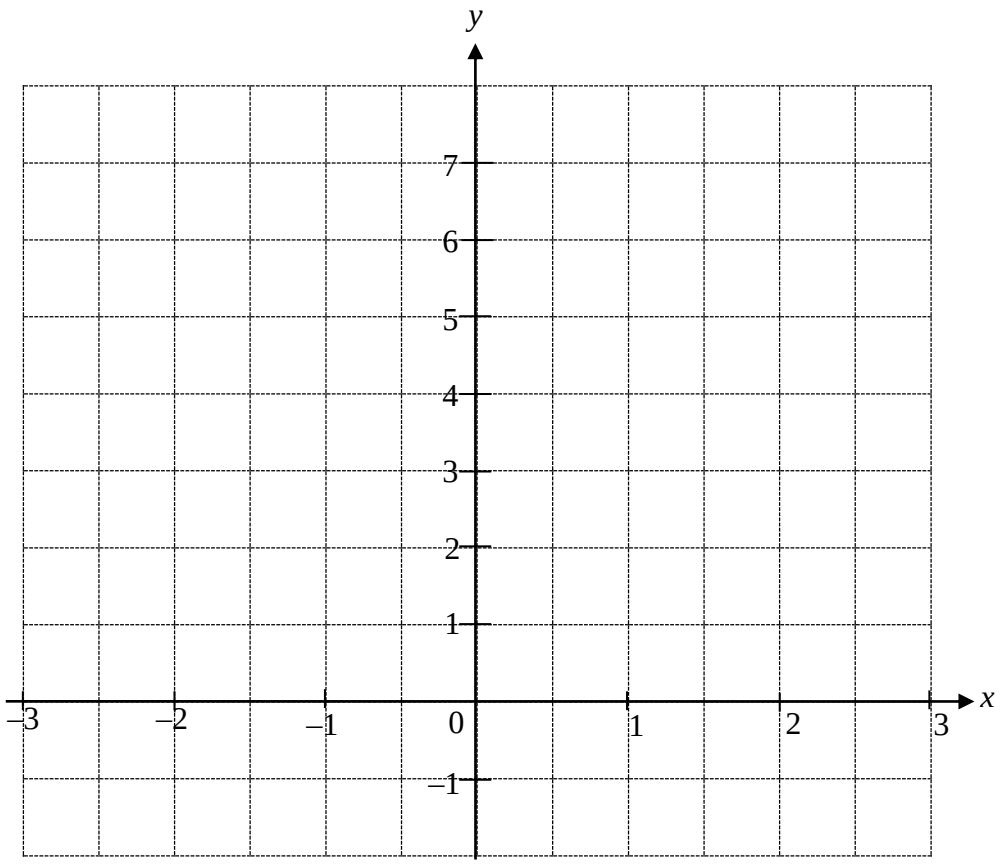
Answer (b) ……..…… cm^2 [3]

22. (a) Complete the table of values for $y + 2x = 3$.

x	–2	–1	0	1	2
y	7	5	3		

[2]

(b) On the grid, draw the line $y + 2x = 3$.



[2]

(c) Write down the coordinates of the point where this line crosses the x–axis.

Answer (c) (…… , ……) [1]

(d) Find the gradient of this line.

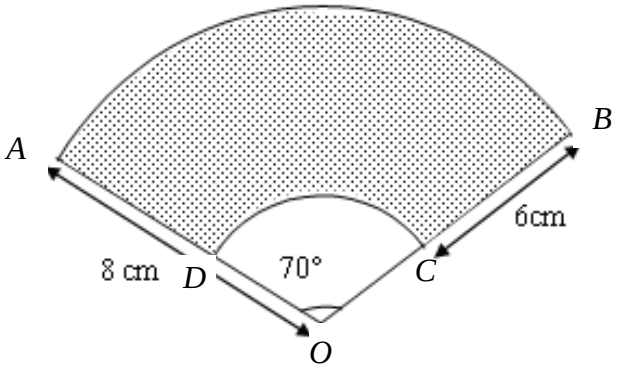
Answer (d) …… [1]

23. *OAB* is a sector of a circle, centre *O*, of radius 8 cm.

ODC is a sector of a circle, centre *O*.

ODA and *OCB* are straight lines.

Angle *AOB* = 70° and *CB* = 6 cm.



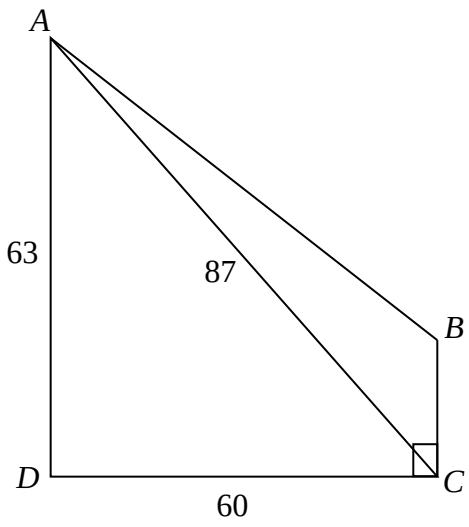
(a) Find the perimeter of the shaded region *ABCD*.

Answer (a) ……..…….… cm [3]

(b) Find the area of *ABCD*.

Answer (b) ……..…… cm^2 [3]

24.



A field *ABCD* has angle *BCD* = 90°, *AD* = 63 m, *DC* = 60 m and *AC* = 87 m.

(a) Show that *ADC* is a right–angled triangle.

Answer (a)

[1]

(b) Find angle *DAC*.

Answer (b) $\angle DAC$ = ……..…… [2]

(c) The area of *ABCD* is 2670 m^2.

Find *BC*.

Answer (c) *BC* = ……...…… m [3]

~ End of Paper 1 ~

Mathematical Formulae

Compound interest

$$\text{Total amount} = P\left(1+\frac{r}{100}\right)^n$$

Mensuration

Curved surface area of a cone = πrl

Surface area of a sphere = $4\pi r^2$

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

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

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

Arc length = $r\theta$, where θ is in radians

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

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

$$a^2 = b^2 + c^2 - 2bc\cos A$$

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$$\text{Mean} = \frac{\Sigma fx}{\Sigma f}$$

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Section A (44 marks)

Answer **all** the questions in this section.

1 By February 2013, the number of Twitter users has reached 200092160.

(a) Express the number of Twitter users in standard form, correct to 4 significant figures. [1]

(b) 200092160 can be written as k billion. Find k. [2]

---

2 Fitri and Raziq invested in a business together in the ratio 5 : 3.

(a) If Fitri invested \$55000, how much did Raziq invest? [1]

(b) In the first year, their business made a profit of \$20550. They shared the profits in the same ratio as their investments.

How much did Fitri receive? [1]

(c) In the second year, the profit increased from \$20550 to \$21824.

Calculate the percentage increase in the profit. [1]

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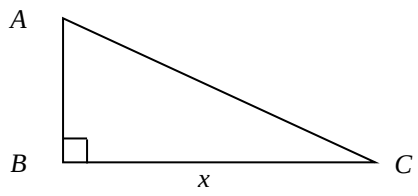
3 The diagram shows a right-angled triangle ABC. The length of BC is x centimetres. AB is 2 cm shorter than BC.



(a) Write down the length of AB in terms of x. [1]

(b) Given that the area of the triangle is 24 cm^2, find the value of x. [2]

(c) Find the length of the longest side of the triangle. [1]

---

4 Nicholas wishes to invest \$15000. The bank provided him with two options.

Option A: Savings account which pay simple interest at the rate of 8% per annum.

Option B: Savings account which pays compound interest at the rate of 8% per annum.

(a) Calculate the number of years for the amount of money saved in Option A to reach a value of \$18600. [2]

(b) Calculate the amount Nicholas would have in his savings account in Option B after 24 months. Give your answer correct to the nearest dollar. [1]

(c) Should Nicholas choose Option A or Option B? Justify your answer. [2]

---

5 **(a)** Express 10 months and 4 years 2 months as a ratio of two integers in its simplest form. [1]

(b) One day the rate of exchange between pounds (£) and United States dollars (\$) was £1 = \$1.52.

On the same day, the rate of exchange between pounds (£) and euros € was £1 = €1.16.

(i) Firdaus changed £500 into dollars.

Calculate how many dollars he received. [1]

(ii) Shawn changed €900 into pounds.

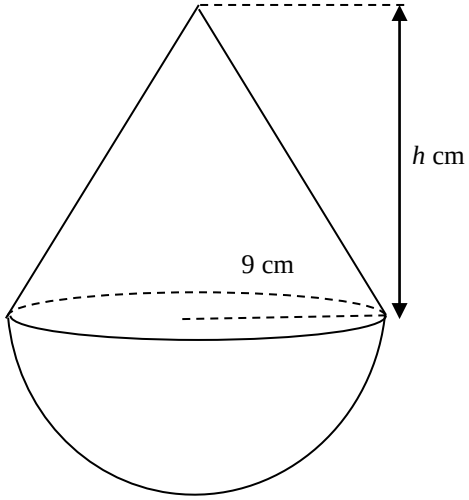
Calculate how many pounds he received. [1]

(iii) David changed \$792 into euros.

Calculate how many euros he received. [2]

---

6 The container below consists of a hollow cone of height h cm glued to a hollow hemispherical base of radius 9 cm.



(a) Express the volume of the hemisphere in terms of π. [1]

(b) Given that the volume of the entire container is 1836π cm^3, show that the value of h is 50. [2]

(c) Initially the container is completely filled with water, but the water leaks from the container at a constant rate of 0.2 litres per second.

Calculate the time taken, in seconds, to empty the container of water. [2]

---

7 **(a)** Make r the subject of the formula $V = \pi r^2 h$. [2]

(b) Solve the following simultaneous equations.

$$3x - 2y = 48$$
$$2x + 3y = -7$$ [3]

---

8 Answer the whole of this question on a single sheet of blank paper.

In this question show all your construction lines.

(a) Given that $AC = 9$ cm, $BC = 10.7$ cm, $\angle ACB = 90°$, construct triangle ABC. [1]

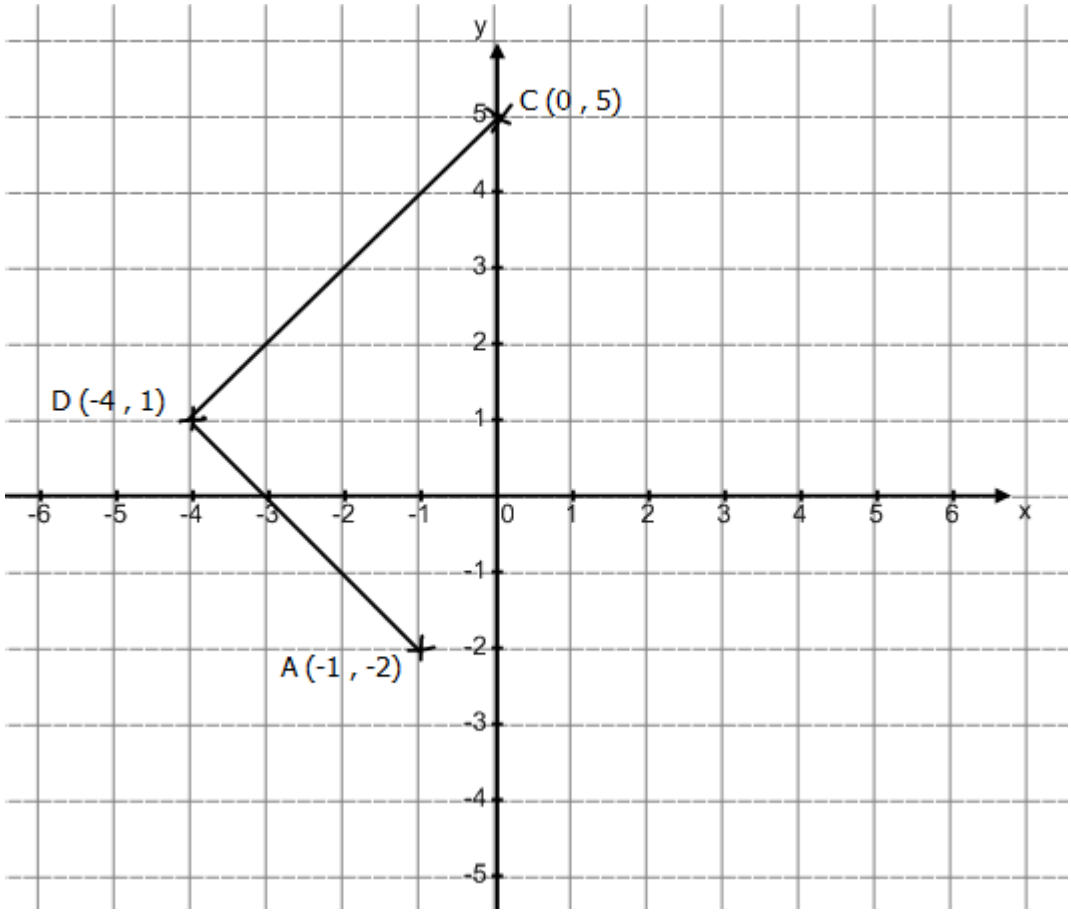
(b) Construct the bisector of angle ACB. [2]

(c) Construct the perpendicular bisector of BC. [2]

(d) The point P is on the bisector of angle ACB and is the same distance from B as it is from C.

Mark and label the position of P. [1]

9 The diagram below shows part of a rectangle *ABCD*. The vertices are $A(-1,-2)$, $C(0,5)$ and $D(-4,1)$.



Find

(a) the coordinates of the point *B*, [1]

(b) the equation of the line *AD*, [3]

(c) the length of line *CD*, [2]

(d) the area of *ABCD*. [2]

Section B (16 marks)

Answer any **two** questions from this section. Each question carries 8 marks.

10 (a) Answer part (a) on lined paper.

Sketch the graph of $y = -(x+4)(x-2)$. [3]

Do **not** make an accurate plot but show, on your sketch, the coordinates of the points where the graph cuts the x and y axes and the coordinates of the minimum or maximum point.

(b) Answer the whole of part (b) on a single sheet of graph paper.

The table below gives corresponding values of x and y related by the equation $y = \frac{1}{3}x(5-x^2)$.

x	-2	-1	0	1	2	2.5	3.5	4
y	-0.7	p	0	1.3	q	-1.0	r	-14.7

(i) Find the values of p, q and r, giving your answers correct to 1 decimal place. [2]

(ii) Draw the graph of $y = \frac{1}{3}x(5-x^2)$. [2]

Use a scale of 2 cm to 1 unit for the horizontal x-axis for $-2 \le x \le 4$ and a scale of 2 cm to 2 units for the vertical y-axis for $-16 \le y \le 4$.

(iii) Find the value of x when $y = -4$. [1]

11 **(a)** The frequency table below summarizes the mass of 500 pieces of 80 g bars of chocolate produced by Machine *X*.

Mass (g)	Frequency
$70 \leq x < 75$	65
$75 \leq x < 80$	105
$80 \leq x < 85$	210
$85 \leq x < 90$	73
$90 \leq x < 95$	47

(i) For Machine *X*, calculate the estimates of the mean and standard deviation of these masses of chocolates. [3]

(ii) Calculate the percentage of chocolates that is lighter than 80 g. [1]

(iii) Another Machine *Y* can also produce similar bars of chocolate. For Machine *Y*, the mean mass of chocolates produced was 81.82 g and the standard deviation was 6.5 g respectively.

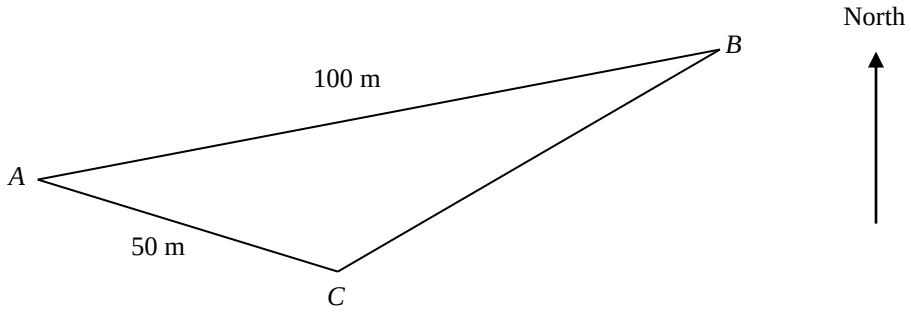
If you are the owner of a chocolate production factory, which machine will you buy? Justify your answer. [1]

(b) A class consists of 12 boys and 18 girls. Two students are selected from the class to go for a competition.

Calculate the probability that one student will be a boy and the other is a girl. [3]

12 **(a)** Calculate the perimeter of the sector of a circle with a radius of 3 cm and an angle of 1.2 radians. [2]

(b) The diagram below shows a triangular field ABC, where $\angle ACB$ is obtuse, $AB = 100$ m and $AC = 50$ m. The bearing of B from A is $080°$ and the bearing of C from B is $240°$.



(i) Show that $\angle ABC = 20°$. [1]

(ii) Find $\angle BAC$. [3]

(iii) Calculate the area of the triangular field ABC. [2]

~ End of Paper 2 ~