Eduqas Summer '23 C2

Examiner only

1.

Use:

$$\text{Pressure} = \frac{\text{Force (N)}}{\text{Area (cm}^2\text{)}}$$

The base of a filing cabinet is a rectangle. It measures 45 cm by 60 cm.
The whole of the base is in contact with the horizontal ground.

(a) The empty filing cabinet exerts a force of 675 N on the ground.

What is the pressure exerted on the ground by the empty filing cabinet?
Give your answer in N/cm^2. [2]

$P = \frac{675}{45 \times 60}$ ✓

$= 0.25$ N/cm^2 ✓

(b) When the filing cabinet is full, the pressure it exerts on the ground is 0·75 N/cm^2.

What is the force that the full filing cabinet exerts on the ground?
Give your answer in newtons (N). [2]

$F = P \times A = 0.75 \times 2700$ ✓

$= 2025$ N ✓

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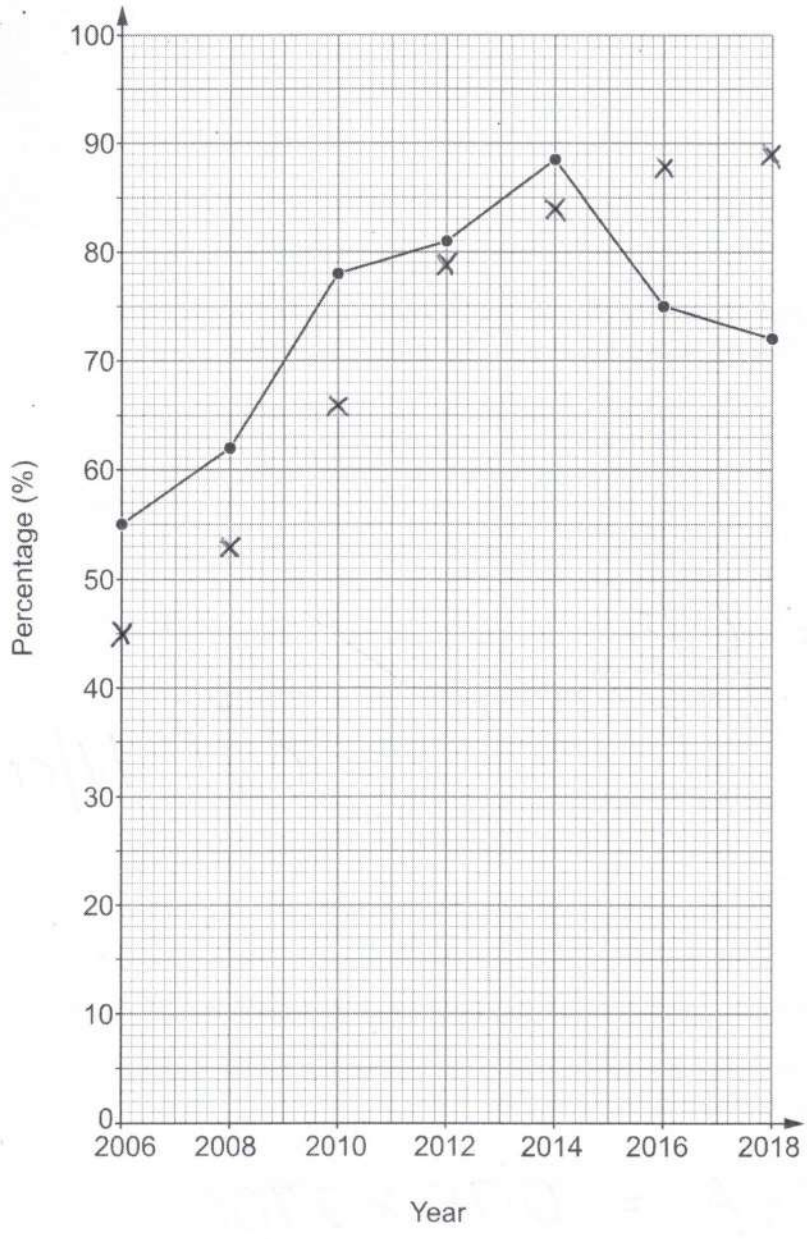
2. The diagram shows information about the percentage of households in Eduvale that owned a **desktop** computer for the even-numbered years from 2006 to 2018.



(a) (i) Complete this statement. [1]

The percentage of households that owned a desktop computer decreased the most between the even-numbered years 2014 and 2016.

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(ii) Jane says,

"The graph shows that 70% of people owned a desktop computer in 2009 because it passes through that point."

Is Jane correct?

Yes ☐ No ☐

Explain how you decide. [1]

2009 data not on graph

(OR)

Jane → 'people', graph → 'households etc

(b) The table shows information about the percentage of households in Eduvale that had an internet connection for the even-numbered years from 2006 to 2018.

Year	2006	2008	2010	2012	2014	2016	2018
Internet connection (%)	45	53	66	79	84	88	89

(i) On the diagram on page 4, plot the information for internet connection. [1]

(ii) In which even-numbered year was the difference in the percentage of households in Eduvale owning a desktop computer and the percentage of households having an internet connection the greatest? [1]

2018

(iii) Eduvale is a large town in a county.

Comment on how, in this **county**, the percentage of households owning a desktop computer and the percentage of households having an internet connection are **likely** to have changed in this time period. [1]

Desktop ownership climbs until 2014 then falls % with internet keeps increasing

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3. Eric is carrying out a survey for a company that makes energy drinks, Pop and Whizz.
He asks 200 randomly selected adults to complete his survey.

(a) Pop costs £1 per bottle.
As part of his survey, Eric wants to find out how much money each month adults spend on Pop.

In the box below, write a suitable question for his survey to collect this information.
You must include response boxes. [2]

✓

How much do you spend on pop per month approx?

✓

0 ☐ 1-3 ☐ 4-6 ☐ 7+ ☐

(b) In another question, he asks the 200 adults how many bottles of Whizz they buy each month.
The table shows the results for the 200 adults.

		Number of bottles			
		0	1 to 4	5 to 10	more than 10
Age (years)	18 to 25	26	12	6	6
	26 to 35	29	34	41	2
	older than 35	32	11	1	0

87

43

Find the probability that an adult chosen at random from these 200

(i) does not buy Whizz, [1]

87/200 ✓OE

(ii) is 26 to 35 years old and buys 5 or more bottles of Whizz each month. [1]

43/200 ✓OE

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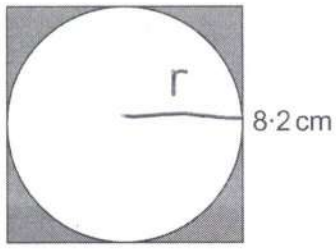
4. (a) The diagram shows a circle inside a square of side 8·2 cm.



$r = 4{\cdot}1$

Diagram not drawn to scale

The sides of the square are tangents to the circle.

Find the area of the shaded region.
You must show all your working. [4]

$A = 8{\cdot}2^2 - \pi \times 4{\cdot}1^2$ ✓✓

$= 14{\cdot}42\ldots$

$= 14{\cdot}4\ \text{cm}^2$ ✓

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(b) The diagram shows a parallelogram.
It is the cross-section of a prism.

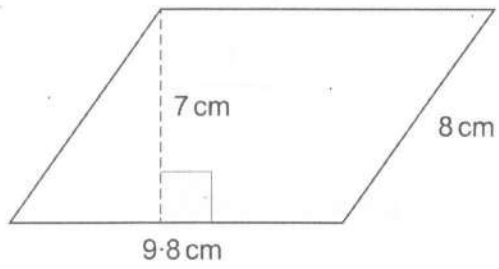

Diagram not drawn to scale

The length of the prism is 16 cm.
Find the volume of the prism. [3]

$V = 9.8 \times 7 \times 16$ ✓✓

$= 1097.6 \text{ cm}^3$ ✓

Examiner only

5. (a) Solve $7x - 5 = 2x + 3$. [2]

$5x = 8$ ✓

$x = \frac{8}{5}$ ✓OE

(b) Roza is buying bananas and apples.

She buys x bananas which cost 30 pence each.
She buys 2 more apples than the number of bananas she buys. $x+2$ ✓
Her apples cost 25 pence each.
She pays a total of £5.45. $= 545p$

Use an algebraic method to find the number of bananas Roza buys. [4]

$30x + 25(x+2) = 545$ ✓

$30x + 25x + 50 = 545$ ✓

$55x = 495$

$x = \frac{495}{55} = 9$ ✓

(c) Factorise $x^2 + 5x + 4$. [2]

$(x+1)(x+4)$ ✓✓

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6. Heath has £3000 to invest for five years.
No extra money will be paid in or withdrawn during these five years.
He is going to choose one of these accounts.

Account A	**Account B**
4% compound interest per year Interest rates can vary	Guaranteed interest at the end of 5 years of £190 for each £1000 invested

(a) Which account gives Heath the greater **percentage increase** in his money at the end of 5 years and by how much is it greater?

Show how you decide. State any assumption that you make. [6]

$A = 3000 \times 1.04^5$ ✓

$= 3649.96$ ✓

$\frac{649.96}{3000} \times 100$

$= 21.7\%$

$B = 190 \times 3$

$= 570$

$\frac{570}{3000} \times 100$ ✓

$= 19\%$ ✓

Account A gives the greater percentage increase by 2.7 % ✓

Assumption A's interest stays the same ✓

(b) Comment on the effect that your assumption in part (a) has had on your decision. [1]

If the rate increases, A would still be better. ✓ etc

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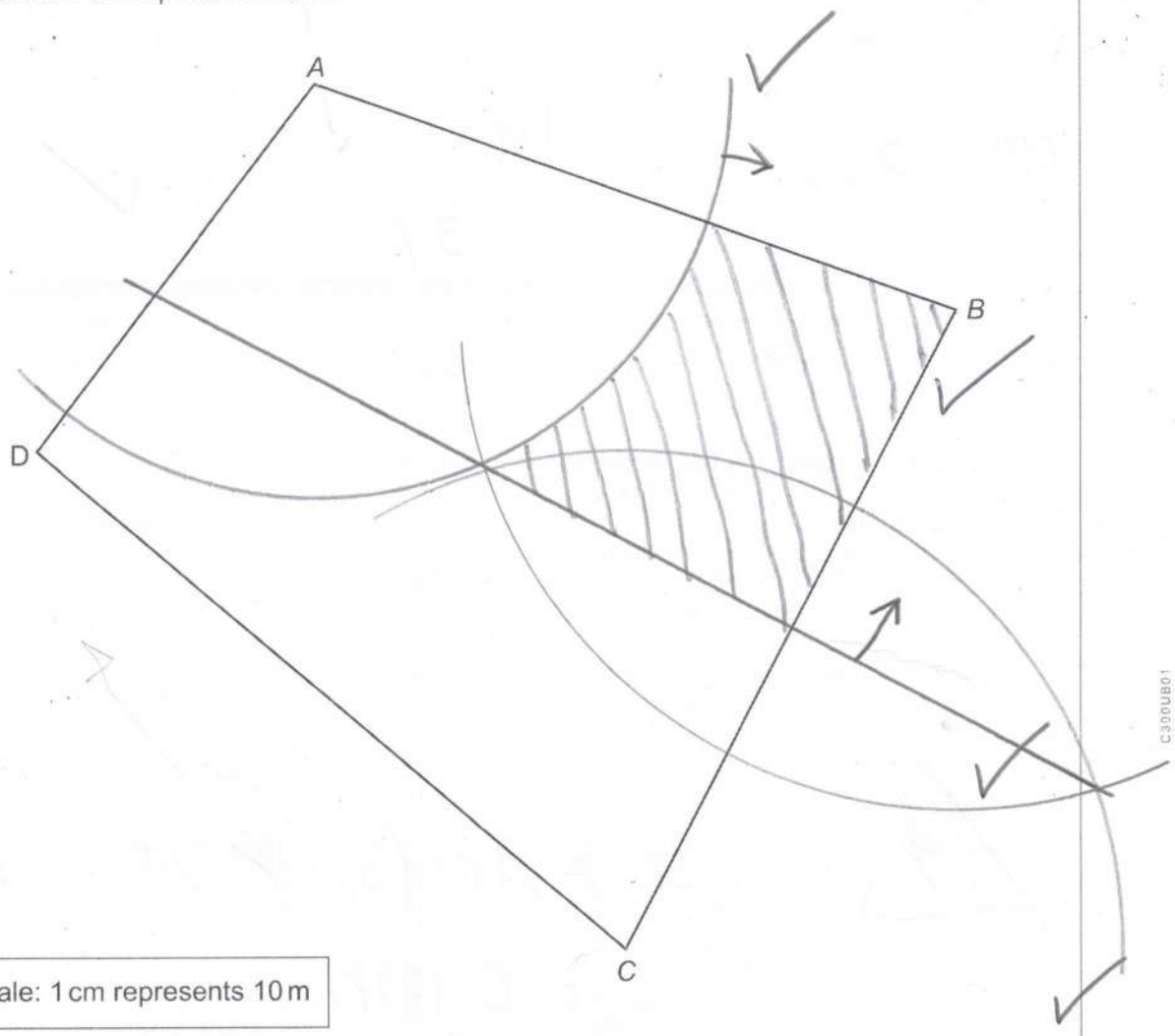
7. The diagram shows a small park with gates at *A*, *B*, *C* and *D*.
The scale is 1 cm represents 10 m.



Scale: 1 cm represents 10 m

A new outdoor gym is to be built in the park.

This should be:

- at least 55 m from the gate at *A* $= 5.5\text{cm}$
- nearer to the gate at *B* than the gate at *C*.

Use a ruler and a pair of compasses to show accurately on the diagram the region of the park where the outdoor gym can be built.
Indicate clearly the region that is your answer. [4]

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8.

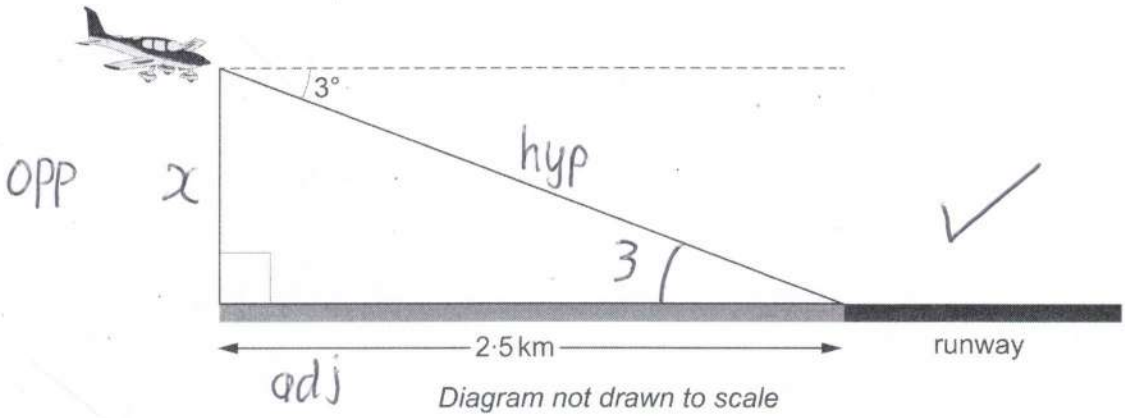


Diagram not drawn to scale

An aircraft is making its final approach ready to land.

The aircraft is:

- flying at 3° to the horizontal,
- 2·5 km horizontally from the start of the runway,

as shown on the diagram above.

Calculate the vertical height of the aircraft above the horizontal ground.
You must show all your working. [4]

SOH CAH TOA

$x = \tan(3) \times 2.5$ ✓✓

$= 0.1310\ldots$

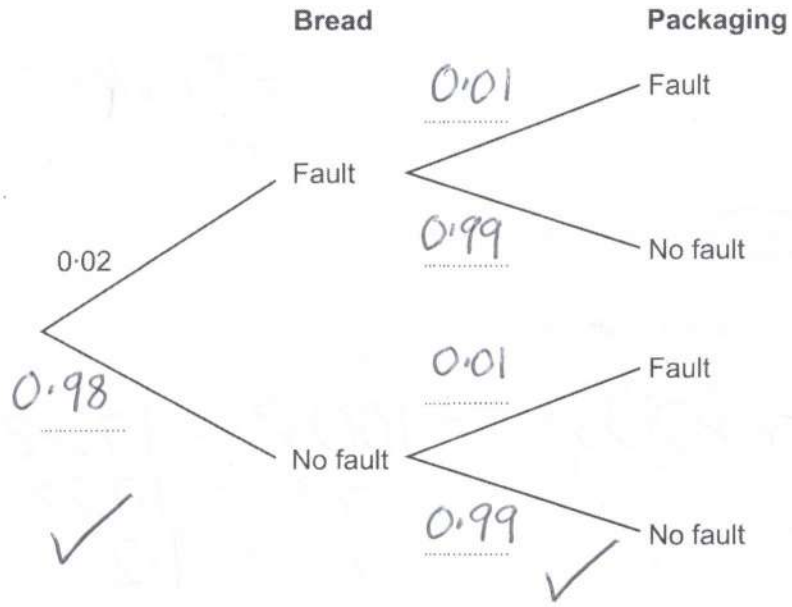
$= 0.13$ km ✓

Examiner only

9. A factory makes loaves of bread which are wrapped in packaging.

Independently, for any loaf wrapped in packaging, chosen at random:
- The probability that there is a fault with the bread is 0·02.
- The probability that there is a fault with the packaging is 0·01.

(a) Complete the tree diagram to show this information. [2]



(b) A loaf wrapped in packaging is chosen at random.

(i) Calculate the probability that neither the bread nor the packaging has a fault. [2]

$0.98 \times 0.99 = 0.9702$ ✓ ✓OE

(ii) Calculate the probability that either the bread or the packaging has a fault but they do not both have a fault. [3]

✓ $(0.02 \times 0.99) + (0.98 \times 0.01)$ ✓

$= 0.0296$ ✓

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10. In this question, all lengths are in metres.
The diagram shows Terry's garden.

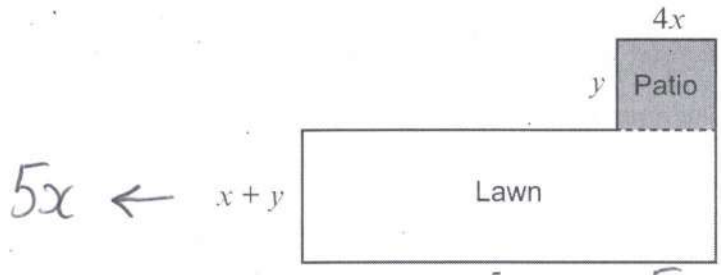


Diagram not drawn to scale

The patio is a **square** and the lawn is a rectangle.
The area of the lawn is 172·8 m².

Use an algebraic method to find the area of Terry's patio. [5]

$L = 5x \times 20x^2 = 100x^3 = 172.8$ ✓✓

$x^3 = 1.728$

$x = 1.2$ ✓

$P = 4x \times 4x$

$= 4.8^2$

Area of Terry's patio = 23.04 m² ✓

Examiner only

11. Rearrange this formula to make y the subject.

$$a = 7(x + y^5) + 2$$

[4]

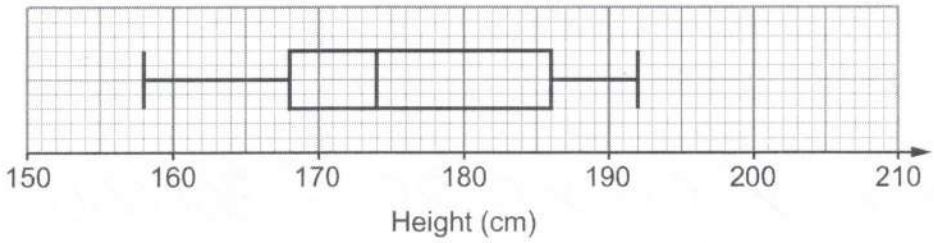
$a - 2 = 7x + 7y^5$ ✓

$a - 2 - 7x = 7y^5$ ✓

$\frac{a - 2 - 7x}{7} = y^5$ ✓

$\sqrt[5]{\frac{a - 2 - 7x}{7}} = y$ ✓ OE

12. The box plot summarises the heights, in cm, of a class of students.



Use the box plot to complete the table. [3]

Range	Median	Lower quartile	Upper quartile	Interquartile range
34	174	168	186	18

192 − 158 ✓ ✓

Examiner only

13.

Enya's house is put up for sale at the start of April.
It does not sell, so at the start of May, the sale price of the house is reduced by 20%.
At the start of June, the sale price is reduced by 15% of the price at the start of May.

(a) Enya says,

"My house has been reduced in price by a total of 35%."

Explain why Enya is incorrect. [1]

15% of 80% NOT 15% of 100%

✓etc

(b) The house is then sold for £306 000.

What was the original sale price of the house at the beginning of April? [4]

$x \times 0{\cdot}8 \times 0{\cdot}85 = 306000$

$x = \dfrac{306000}{0{\cdot}8 \times 0{\cdot}85} = 450000$ ✓✓

✓ ✓

Examiner only

14. The area of country *A* is 1 078 000 km^2, correct to 4 significant figures.
The area of country *B* is 249 300 km^2, correct to 4 significant figures.
The two countries merge to form country C.

(a) Calculate the upper bound of the area of country C. [2]

1078500 → 1,327,850
1078000 ← 1077500
249350
249300 ← 249250

(b) The population density of a country is the number of people per km^2.
Country *C* has a population of 82 000 000, correct to the nearest million.

Calculate the least possible value of the population density for country *C*.
You must show all your working. [3]

82,000,000 LB = 81,500,000 ✓

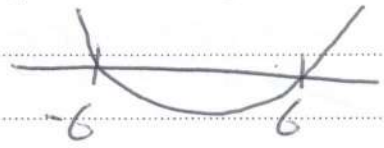
✓ $\frac{81,500,000}{1327850}$ = 61·377...

= 61·4 ✓

Examiner only

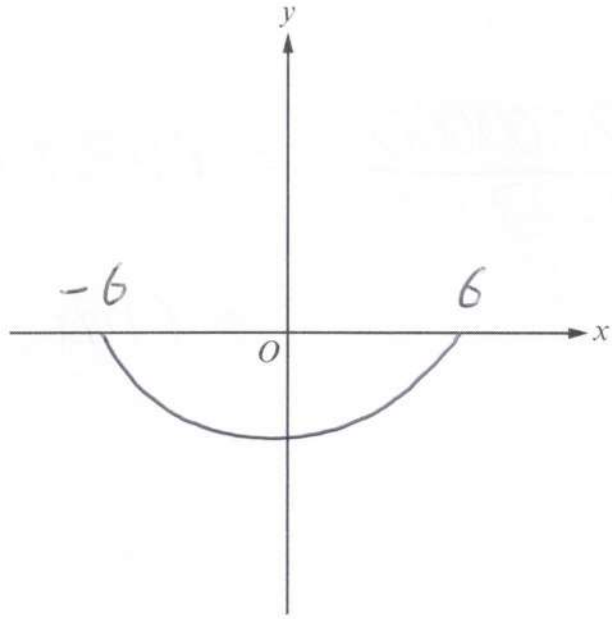
15. (a) Solve $x^2 - 36 \leqslant 0$. [3]

$(x-6)(x+6)$ ✓



$-6 \leqslant x \leqslant 6$ ✓✓

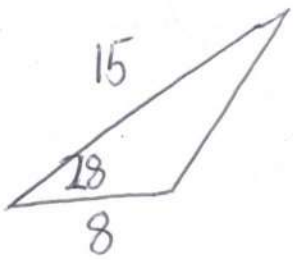
(b) On the axes below, sketch the part of the graph $y = x^2 - 36$ that represents the solution to the inequality $x^2 - 36 \leqslant 0$.
Mark any intercepts with the x-axis on your sketch. [2]



✓
✓

Examiner only

16.



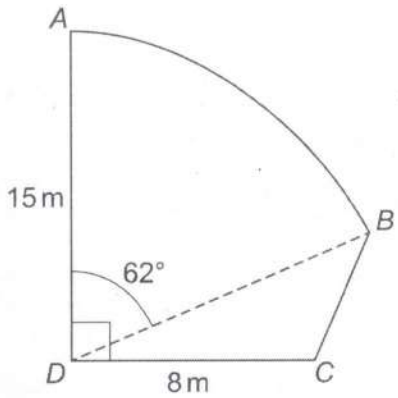


Diagram not drawn to scale

The diagram shows a sector, *ABD*, of a circle with centre *D* and a triangle, *BCD*.
$A\hat{D}C$ is a right angle.

Show that the area of *ABCD* is 150 m^2, correct to 3 significant figures. [5]

Sector DAB $= \pi \times 15^2 \times \frac{62}{360} = 121.736...$ ✓

$\triangle DBC = \frac{1}{2} \times 8 \times 15 \times \sin 28$ ✓ $= 28.168$ ✓

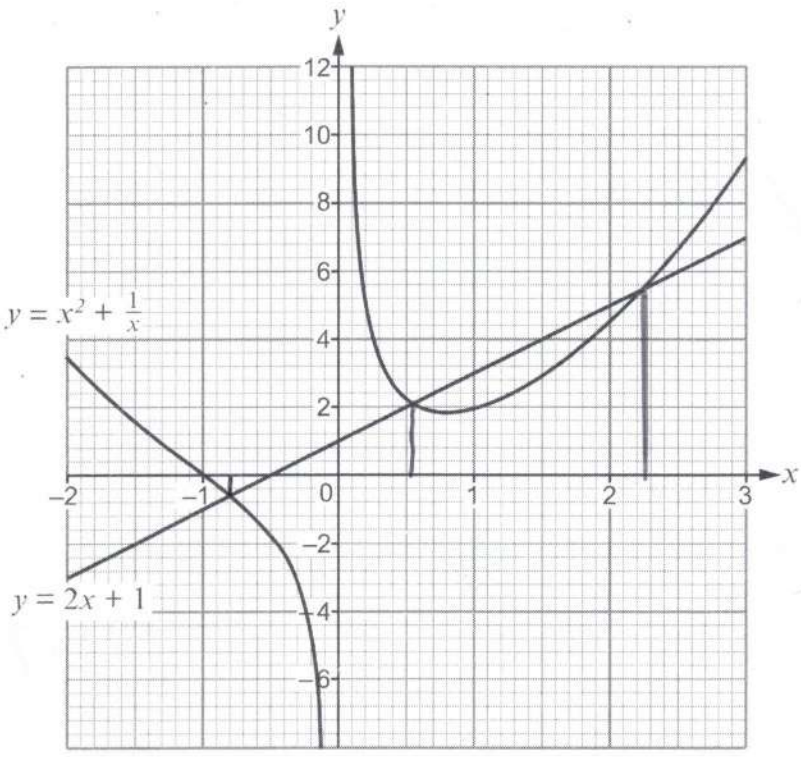
$28.168 + 121.736$

$= 149.904$ ✓

$= 150$ (3sf)

Examiner only

17. The diagram shows the graphs of $y = x^2 + \frac{1}{x}$ and $y = 2x + 1$ for values of x between –2 and 3.



(a) Show that where the line and curve intersect, x satisfies the equation $x^3 - 2x^2 - x + 1 = 0$. [3]

$x^2 + \frac{1}{x} = 2x + 1$ ✓

$x^3 + 1 = 2x^2 + x$ ✓ ✓

$x^3 - 2x^2 - x + 1 = 0$

(b) Write down the solutions to the equation $x^3 - 2x^2 - x + 1 = 0$.
Give your answers correct to 1 decimal place. [2]

$x = -0.8$ ✓ $x = 0.5$ or 0.6 ✓ $x = 2.2$ or 2.3 ✓

Examiner only

18. (a) $f(x) = x^3$

Find $f^{-1}(x)$. [1]

$f^{-1}(x) = \sqrt[3]{x}$ ✓

(b) $g(x) = (5x-1)^3$

Expand and simplify $g(x)$. [3]

$(5x-1)(5x-1) = 25x^2 - 5x - 5x + 1$

$= 25x^2 - 10x + 1$ ✓

$25x^2 - 10x + 1$

$125x^3$	$-50x^2$	$+5x$	$5x$
$-25x^2$	$+10x$	-1	-1

✓

$g(x) = 125x^3 - 75x^2 + 15x - 1$ ✓

Examiner only

19. (a)

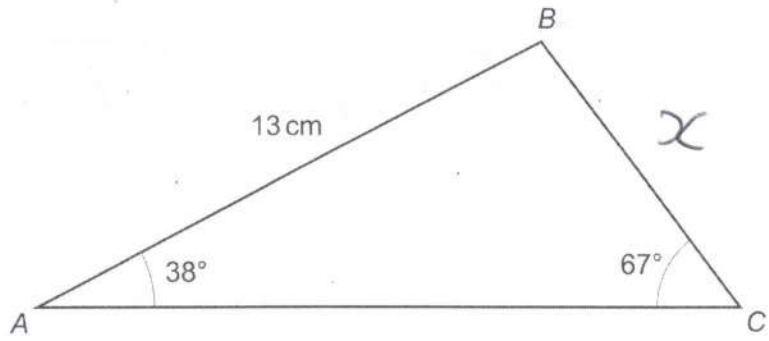


Diagram not drawn to scale

Calculate the length of *BC*. [3]

$\frac{x}{\sin 38} = \frac{13}{\sin 67}$ ✓

$x = \frac{13 \sin 38}{\sin 67} = 8.694\ldots$

$= 8.7$ cm

✓ ✓

Examiner only

(b)

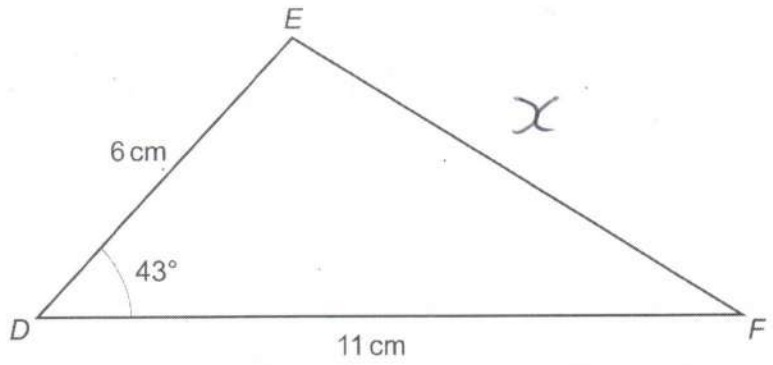


Diagram not drawn to scale

Calculate the length of *EF*. [3]

$x^2 = 6^2 + 11^2 - 2 \times 6 \times 11 \times \cos 43$ ✓

$x = \sqrt{60.461\ldots}$ ✓

$x = 7.775\ldots = 7.8\text{ cm}$ ✓

Examiner only

20. Sian has seven numbered cards as shown below.

She shuffles them and turns them face down.
She then turns them over to make a 7-digit number.

(a) How many different 7-digit numbers can Sian make? [2]

✓ 7! = 5040 ✓

(b) How many of these 7-digit numbers are multiples of 5? [2]

_ _ _ _ _ _ 5

✓ 6! = 720 ✓

(c) What proportion of these 7-digit numbers are **not** multiples of 5? [1]

$\frac{4320}{5040}$ ✓OE

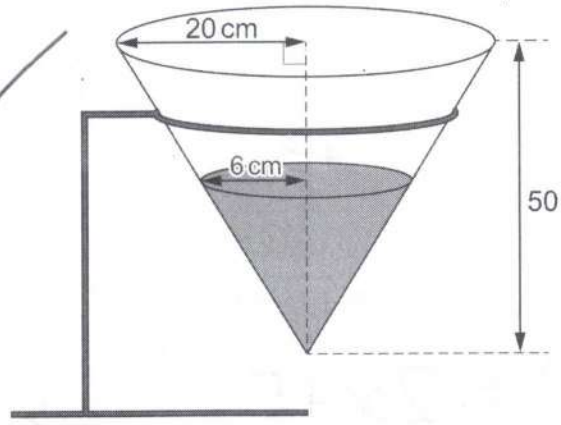
Examiner only

21. An inverted cone is held in a stand.

The radius of the cone is 20 cm and the height of the cone is 50 cm.

$\frac{6}{20} \times 50$ ✓

$= 15$ ✓



} Rhian

} Jake

Diagram not drawn to scale

Jake pours some water into this cone.
When he stops, the radius of the surface of the water is 6 cm.
The surface of the water is parallel to the base of the cone.

Rhian then pours water into the cone until it is completely full.
She pours the water at a rate of 1 litre per 10 seconds.

How many seconds does it take Rhian to fill the cone? [7]

$Vol_{RH} = \frac{1}{3}\pi \times 20^2 \times 50 - \frac{1}{3}\pi \times 6^2 \times 15$ ✓✓

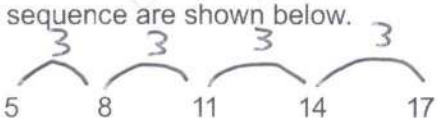
$= \frac{19460\pi}{3}$ cm^2 = ml ✓

$= 20.37846$ litres ✓

$= 203.78$ secs ✓ etc

Examiner only

22. (a) The first 5 terms of a sequence are shown below.



Complete the term-to-term rule for this sequence. [1]

$t_1 = 5$

$t_{n+1} = t_n$ +3 , $n \geqslant 1$ ✓

(b) (i) Show that $x^3 - 2x - 5 = 0$ can be rearranged as $x = \sqrt{\frac{2x+5}{x}}$. [1]

$x^3 = 2x + 5$

$x^2 = \frac{2x+5}{x}$ ✓

so $x = \sqrt{\frac{2x+5}{x}}$

(ii) Use the iterative formula $x_{n+1} = \sqrt{\frac{2x_n + 5}{x_n}}$ with $x_1 = 2$

to find a solution of $x^3 - 2x - 5 = 0$ correct to 1 decimal place.

Write down all your values of x_{n+1}. [3]

$x_2 = 2{\cdot}121\ldots$ ✓

$x_3 = 2{\cdot}087\ldots$

$x_4 = 2{\cdot}096\ldots$ ✓

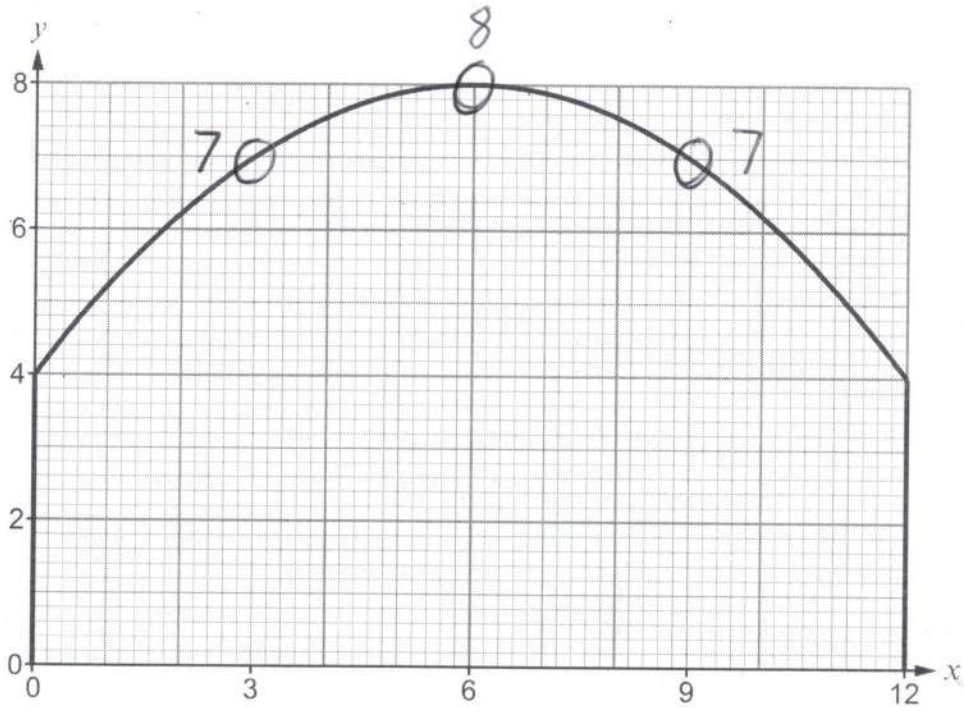
$x_5 = 2{\cdot}094\ldots$

$x_6 = 2{\cdot}094\ldots$

$x = 2{\cdot}1$ ✓

Examiner only

23. In this question, x and y are horizontal and vertical distances in metres.
An engineer designs a tunnel.
He models the uniform cross-section of this tunnel using the graph shown in the diagram.



The tunnel is 50 metres long and will cost £250 per m^3 to excavate.

Use the graph with four vertical strips of equal width to calculate an estimate of the cost of excavating this tunnel. [6]

$A = \frac{3}{2}(4+7 + 7+8 + 8+7 + 7+4)$ ✓ ✓ OE

$= 78\,m^2$ ✓

$78 \times 50 \times 250$ ✓

Cost of excavating the tunnel will be £ 975,000 ✓

END OF PAPER