

Dr Oliver Mathematics
GCSE Mathematics
2022 November Paper 3H: Calculator
1 hour 30 minutes

The total number of marks available is 80.

You must write down all the stages in your working.

1. Make a the subject of the formula (2)

$$p = 3a - 9.$$

2. Rob has been asked to divide 120 in the ratio 3 : 5. (1)

Here is his working.

$$120 \div 3 = 40 \quad 120 \div 5 = 24.$$

Rob's working is not correct.

Describe what Rob has done wrong.

3. 200 students chose one language to study. (3)

Each student chose one language from French or Spanish or German.

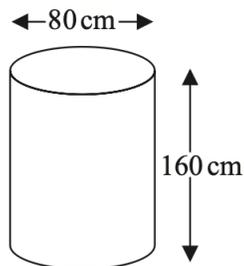
Of the 200 students,

- 90 are boys and the rest of the students are girls,
- 70 chose Spanish,
- 60 of the 104 students who chose French are boys, and
- 18 girls chose German.

Work out how many boys chose Spanish.

4. Karina has 4 tanks on her tractor. (4)

Each tank is a cylinder with diameter 80 cm and height 160 cm.



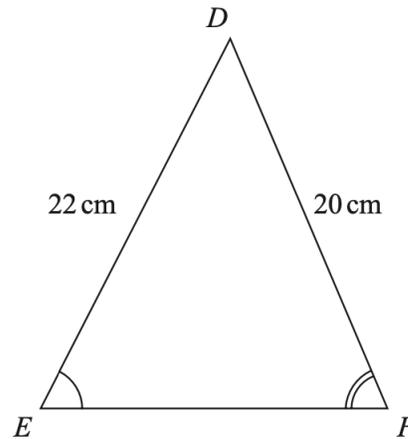
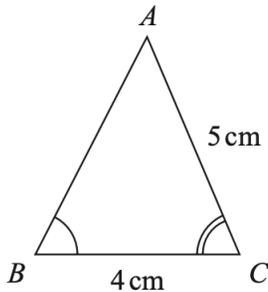
The 4 tanks are to be filled completely with a mixture of fertiliser and water.

The fertiliser has to be mixed with water in the ratio 1 : 100 by volume.
Karina has 32 litres of fertiliser.

1 litre = 1 000 cm³.

Has Karina enough fertiliser for the 4 tanks?
You must show how you get your answer.

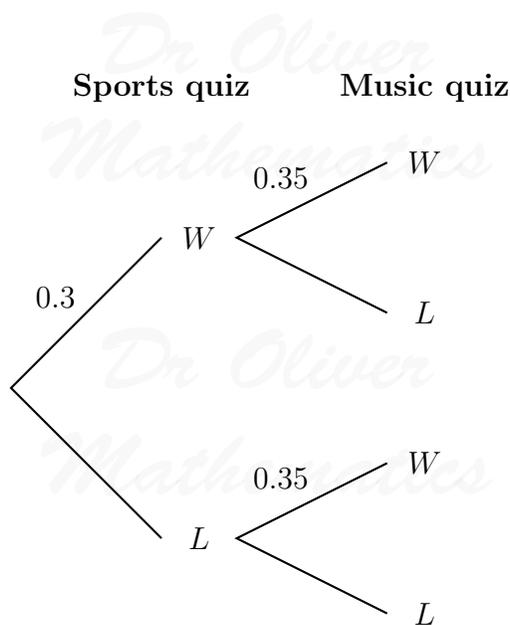
5. Triangle ABC and triangle DEF are similar.



- (a) Work out the length of EF . (2)
- (b) Work out the length of AB . (2)
6. One weekend the Keddie family is going to do a sports quiz and a music quiz.

The probability that the family will win the sports quiz is 0.3.
The probability that the family will win the music quiz is 0.35.

- (a) Complete the probability tree diagram. (2)



(b) Work out the probability that the Keddie family will win both the sports quiz and the music quiz. (2)

7. (a) Change $8\,000\text{ cm}^3$ to m^3 . (1)

(b) Change a speed of 180 km per hour to metres per second. (3)

8. There are 30 women and 20 men at a gym. (3)

The mean height of all 50 people is 167.6 cm.

The mean height of the 20 men is 182 cm.

Work out the mean height of the 30 women.

9. (a) Write (1)

$$6.75 \times 10^{-4}$$

as an ordinary number.

(b) Work out (2)

$$\frac{(2.56 \times 10^6) \times (4.12 \times 10^3)}{1.6 \times 10^{-2}}$$

Give your answer in standard form.

10. Peter has to subtract $(x^2 - 2x - 4)$ from $(x^2 + 3x + 5)$. (1)

Here is his working.

$$\begin{aligned} & (x^2 + 3x + 5) - (x^2 - 2x - 4) \\ = & x^2 + 3x + 5 - x^2 - 2x - 4 \\ = & x + 1. \end{aligned}$$

Explain what is wrong with Peter's working.

11. x and y are integers such that (2)

- $3 < x < 8$,
- $4 < y < 10$, and
- $x + y = 14$.

Find all the possible values of x .

12. Martin used his calculator to work out the value of a number P . (2)

He wrote down the first two digits of the answer on his calculator.

He wrote down 1.2.

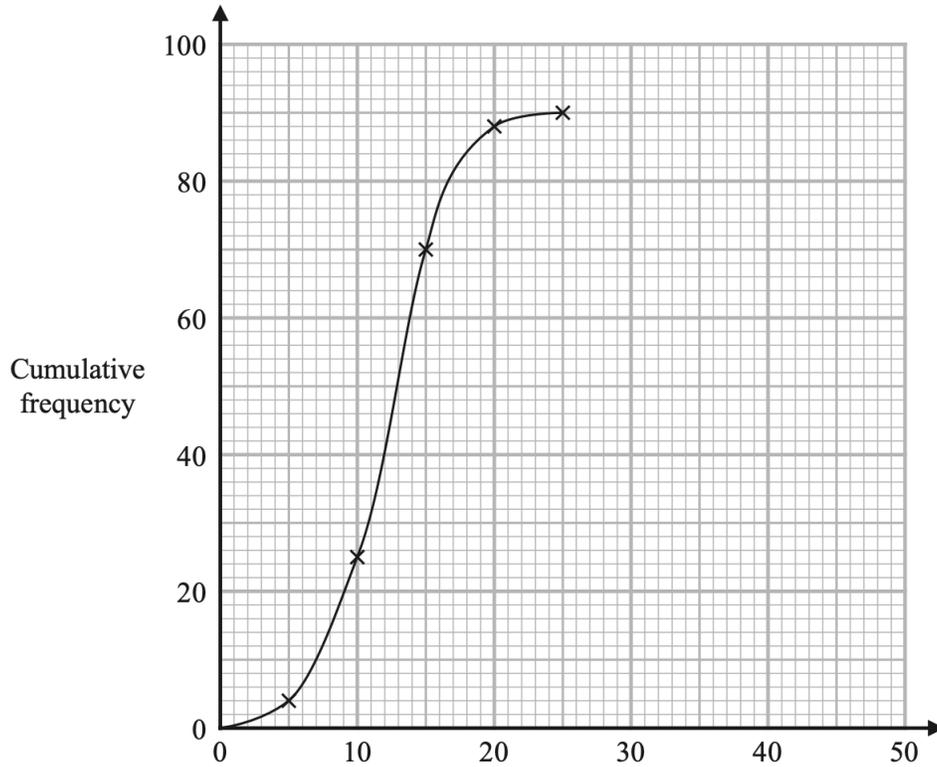
Complete the error interval for P :

$$\dots\dots \leq P < \dots\dots$$

13. Chen has this information about the time that it took an operator at a call centre to answer each of 90 calls. (2)

Time (t seconds)	Cumulative frequency
$0 < t \leq 10$	4
$0 < t \leq 20$	25
$0 < t \leq 30$	70
$0 < t \leq 40$	88
$0 < t \leq 50$	90

Chen draws this cumulative frequency graph for the information in the table.



Write down two different things that are wrong with this graph.

14. (a) Simplify fully (2)
$$(3x^5y^6)^4.$$

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

15. A pet shop has (2)

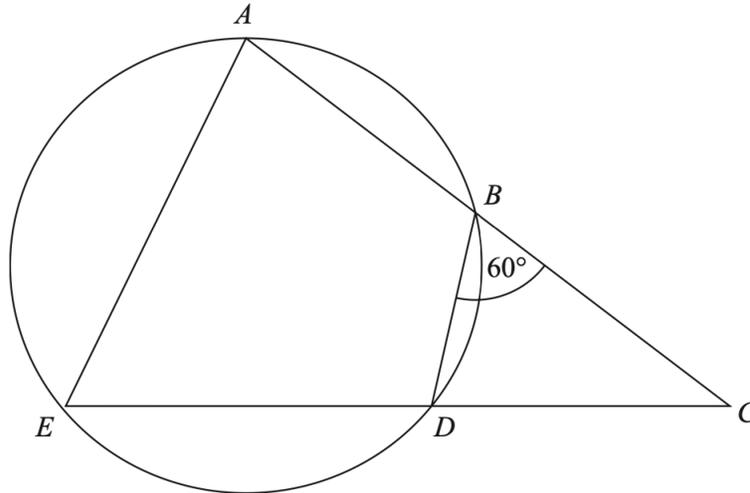
- 7 guppy fish,
- 13 tetra fish, and
- 5 angel fish.

David is going to choose one of the following combinations of fish

- a guppy fish and an angel fish,
- **or** a tetra fish and an angel fish,
- **or** a guppy fish, a tetra fish, and an angel fish.

Show that there are 555 different ways for David to choose his fish.

16. $ABDE$ is a cyclic quadrilateral. (4)
 ABC and EDC are straight lines.
 Angle $DBC = 60^\circ$.



Given that

$$\text{size of angle } EAB : \text{size of angle } BCD = 2 : 1,$$

work out the size of angle BCD .

You must show all your working.

17. There are four boxes on a shelf: **A**, **B**, **C**, and **D**. (4)

The total weight of **A** and **B** is 3 times the total weight of **C** and **D**.

The weight of **A** is $\frac{2}{3}$ of the weight of **B**.

The weight of **C** is 75% of the weight of **D**.

Find the ratio

$$\text{weight of } \mathbf{A} : \text{weight of } \mathbf{B} : \text{weight of } \mathbf{C} : \text{weight of } \mathbf{D}.$$

18. Shape **A** is reflected in the line with equation $x = 2$ to give shape **B**. (2)
 Shape **B** is reflected in the line with equation $x = 6$ to give shape **C**.

Describe fully the single transformation that maps shape **A** onto shape **C**.

19. There are only blue counters, red counters, and green counters in a box. (3)

The probability that a counter taken at random from the box will be blue is 0.4.

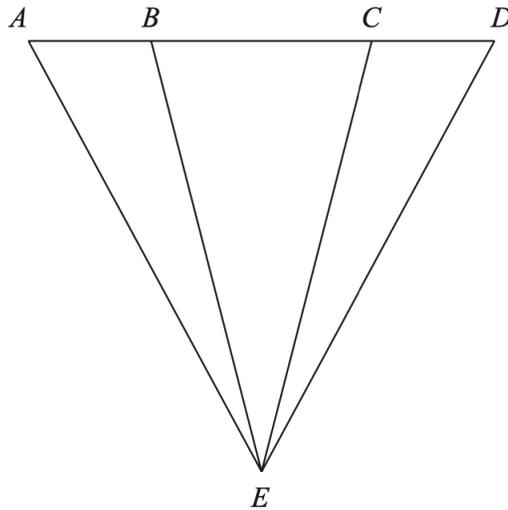
The ratio of the number of red counters to the number of green counters is 7 : 8.

Sameena takes at random a counter from the box.
She records its colour and puts the counter back in the box.
Sameena does this a total of 50 times.

Work out an estimate for the number of times she takes a green counter.

20. The diagram shows a triangle ADE .

(3)



$AE = DE$.

$AB : BC : CD = 1 : 2 : 1$.

Prove that triangle ACE is congruent to triangle DBE .

21. The equation of a curve is

(3)

$$y = 4x^2 - 56x.$$

The curve has one turning point.

By completing the square, show that the coordinates of the turning point are $(7, -196)$.
You must show all your working.

22.

(3)

$$\frac{2x + 3}{x - 5} + \frac{x - 4}{x + 5} - 3$$

can be written in the form

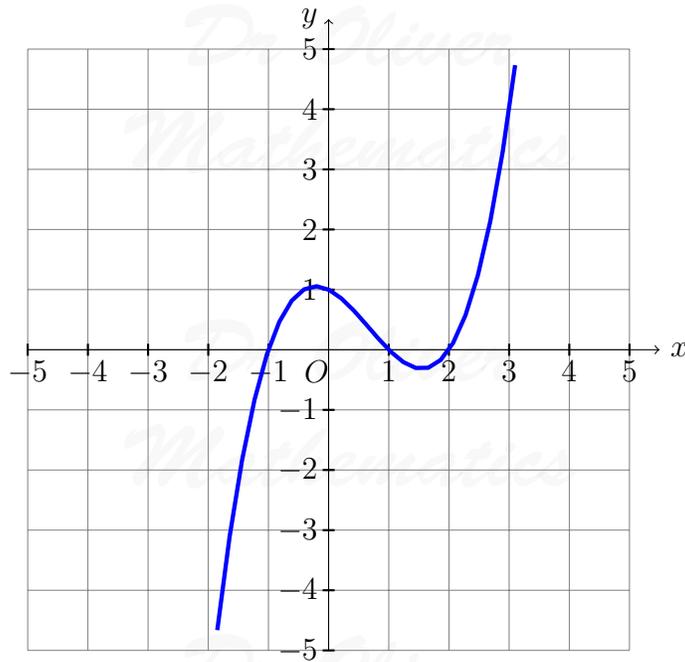
$$\frac{ax + b}{x^2 - 25},$$

where a and b are integers.

Work out the value of a and the value of b .

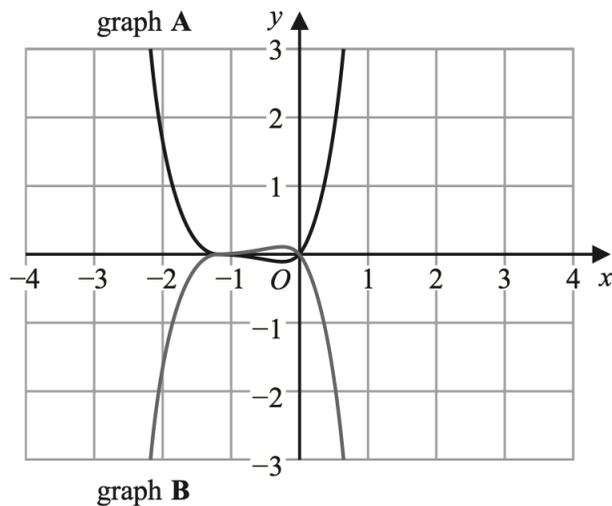
You must show all your working.

23. The graph of $y = f(x)$ is shown on the grid below.



(a) On the grid above, sketch the graph of $y = f(x + 2)$.

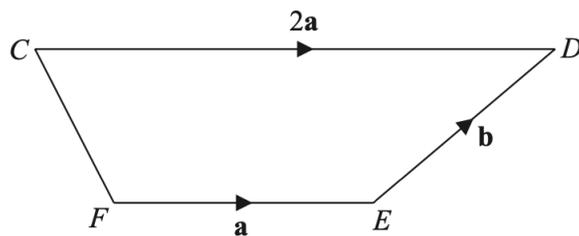
(1)



On this grid, graph **A** has been reflected to give graph **B**.
The equation of graph **A** is $y = g(x)$.

(b) Write down an equation of graph **B**. (1)

24. $CDEF$ is a quadrilateral. (4)

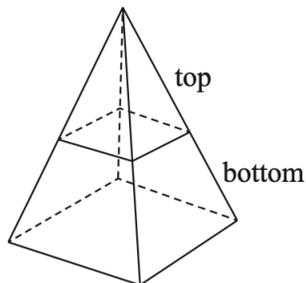


- $\overrightarrow{FE} = \mathbf{a}$.
- $\overrightarrow{ED} = \mathbf{b}$.
- $\overrightarrow{CD} = 2\mathbf{a}$.

The point P is such that CEP is a straight line and that $CE = EP$.

Use a vector method to prove that CF is parallel to DP .

25. The pyramid **P** is formed from two parts made of different materials. (5)

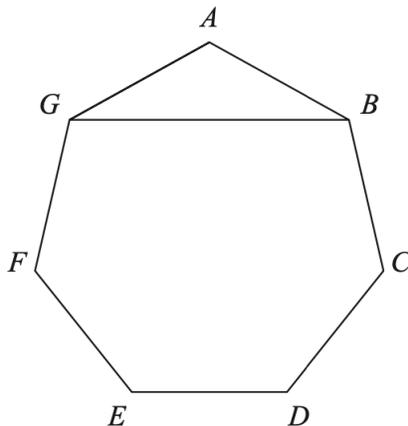


- The top part of **P** has a mass of 92.8 g and is made from material with a density of 2.9 g/cm^3 .
- The bottom part of **P** has a mass of 972.8 g.
- The average density of **P** is 4.7 g/cm^3 .

Calculate the volume of the top part of **P** as a percentage of the total volume of **P**.
Give your answer correct to 1 decimal place.
You must show all your working.

26. $ABCDEFG$ is a regular heptagon.

(5)



The area of triangle ABG is 30 cm^2 .

Calculate the length of GB .

Give your answer correct to 3 significant figures.

You must show all your working.