Dr Oliver Mathematics
AQA GCSE Mathematics
2017 June Paper 3: Calculator
1 hour 30 minutes

The total number of marks available is 80.
You must write down all the stages in your working.

1. ? (1)

$$\mathbf{a} = \begin{pmatrix} -4 \\ -1 \end{pmatrix} \text{ and } \mathbf{b} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}.$$

Circle the vector $2\mathbf{a} + \mathbf{b}$.

$$\begin{pmatrix} -5 \\ -3 \end{pmatrix} \quad \begin{pmatrix} -11 \\ -3 \end{pmatrix} \quad \begin{pmatrix} -5 \\ -1 \end{pmatrix} \quad \begin{pmatrix} -11 \\ -1 \end{pmatrix}$$

2. Which of these values of n makes (1)
$$2.7 \times 10^n$$

a cube number?

Circle your answer.

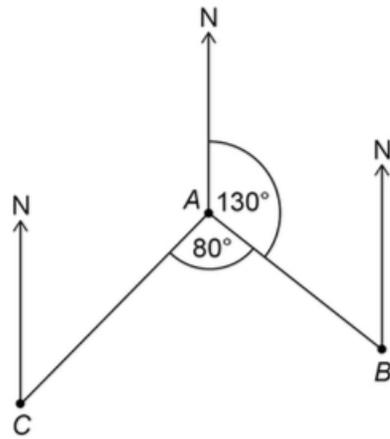$$0 \quad 1 \quad 2 \quad 3$$

3. Rearrange (1)
$$2x = \frac{y}{w}$$

to make w the subject.

Circle your answer.

$$w = \frac{2y}{x} \quad w = \frac{2x}{y} \quad w = \frac{y}{2x} \quad w = \frac{x}{2y}$$

4. Work out the bearing of C from A. (1)

Not drawn accurately

Circle your answer.

$$030° \quad 130° \quad 150° \quad 210°$$

5. A coin lands on Tails 200 times. (2)
   The relative frequency of Tails is 0.4.

   Work out the number of times the coin was thrown.

6. How are the whole number solutions to A and B different? (2)

   $$A: \quad \text{Solve } 3 \leqslant 3x < 18$$
 $$B: \quad \text{Solve } 3 < 3x \leqslant 18.$$

7. (a) The length of a pipe is 6 metres to the nearest metre. (2)
       Complete the error interval for the length of the pipe.

   (b) The length of a different pipe is 4 metres to the nearest metre. (2)

       Olly says, "The total length of the two pipes is 11 metres to the nearest metre."

       Give an example to show that he could be correct.

8. This shape is made from two triangles and four congruent parallelograms.
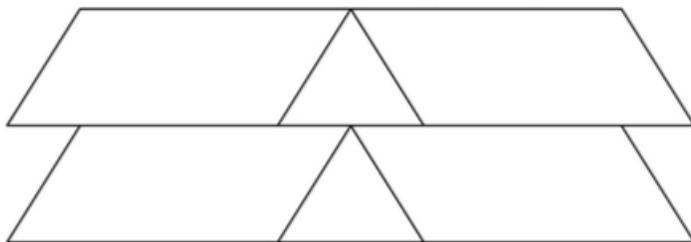
Not drawn accurately

For each statement, tick the correct box.

(a) The triangles are equilateral. (1)

☐ Must be true

☐ Could be true

☐ Must be false

(b) The triangles are congruent. (1)

☐ Must be true

☐ Could be true

☐ Must be false

9. There are 720 boys and 700 girls in a school.

- The probability that a boy chosen at random studies French is $\frac{2}{3}$.
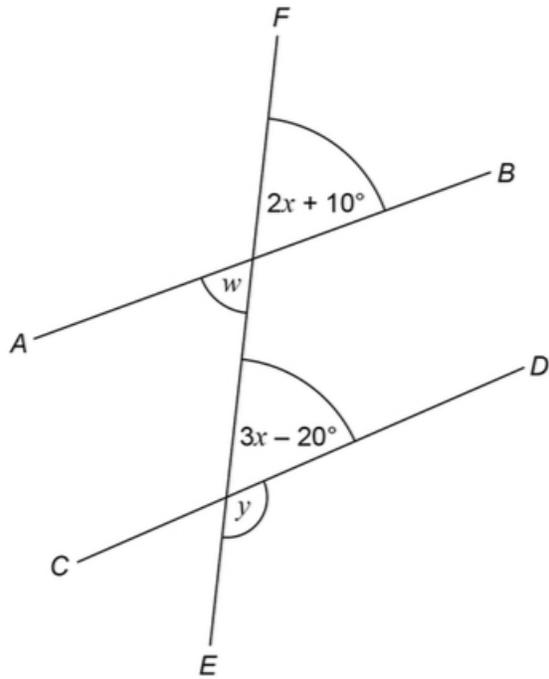- The probability that a girl chosen at random studies French is $\frac{3}{5}$.

(a) Work out the number of students in the school who study French. (3)

(b) Work out the probability that a student chosen at random from the whole school does **not** study French. (2)

10. AB, CD, and EF are straight lines.

F

B

2x + 10°

w

A

D

3x − 20°

y

C

E

(a) Ava assumes that AB and CD are parallel. (4)
What answer should she get for the size of angle y?

(b) In fact, (3)

- AB and CD are **not** parallel.
- w is 60°.

What effect does this have on the size of angle y?
Tick a box.

☐ y is bigger

☐ y is the same

☐ y is smaller

Show working to support your answer.

11. Purple paint is made by mixing red paint and blue paint in the ratio $5 : 2$. (3)

Yan has 30 litres of red paint and 9 litres of blue paint.

What is the maximum amount of purple paint he can make?

12. (2)
$$(ar^b)^4 = 16r^{20},$$
where a and b are positive integers.

Work out a and b.

13. In a class of 28 students (4)

- the mean height of the 12 boys is 1.58 metres and
- the mean height of all 28 students is 1.52 metres.

Work out the mean height of the girls.

14. (1)
$$xy = c,$$
where c is a constant.

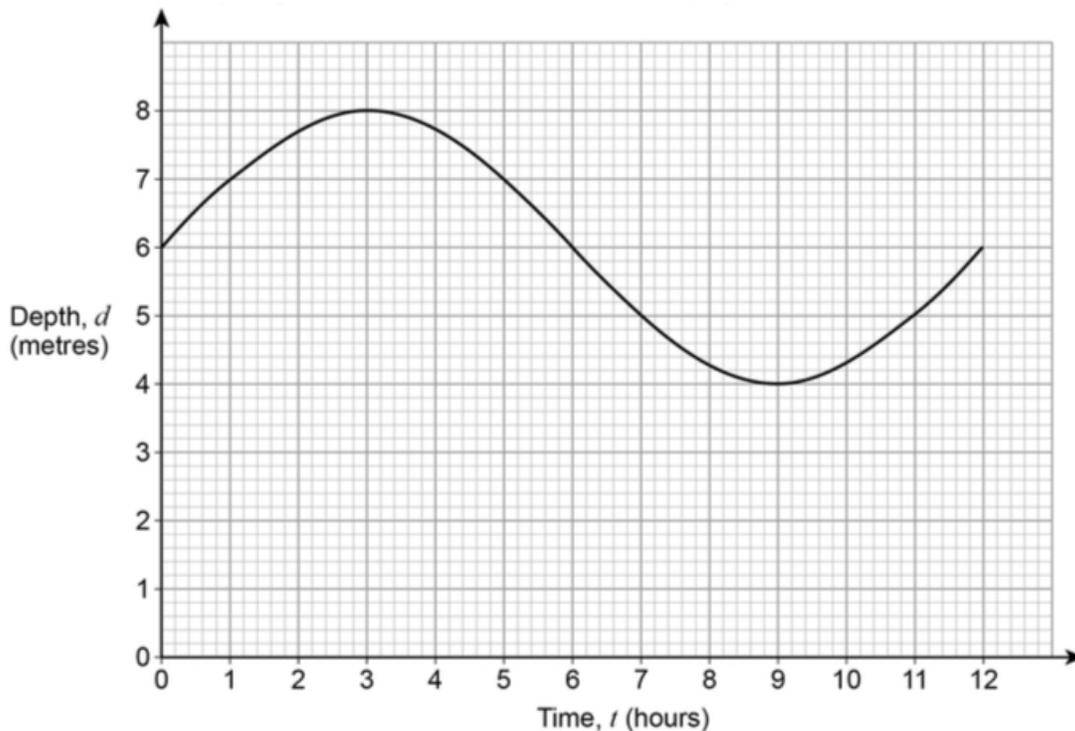Circle the correct statement.

y is directly proportional to x

y is directly proportional to $\dfrac{1}{x}$

y is inversely proportional to $\dfrac{1}{x}$

x is directly proportional to y

15. The graph shows the depth of water in a harbour for 12 hours.

- d is the depth of water in a harbour in metres.
- t is the number of hours after 9 am.

(a) For how many of the 12 hours is the depth more than 5 metres? (1)

(b) By how much does the depth change between 12 noon and 4 pm? (1)

16. The value of a new car is £18 000. (3)

The value of the car decreases by

- 25% in the first year and
- 12% in each of the next 4 years.

Work out the value of the car after 5 years.

17. Liam drives his car. (5)

- He drives the first 9 miles in 9 minutes.
- He then drives at an average speed of 70 miles per hour for 1 hour 36 minutes.
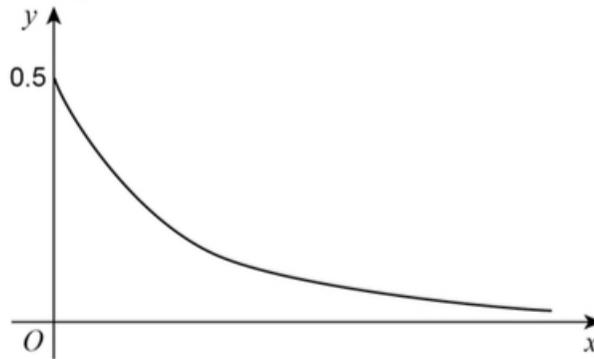
He finds this information about his car.

Average speed	Miles travelled per gallon
65 miles per hour or less	50
More than 65 miles per hour	40

Use the information to show that his car uses less than 3 gallons of petrol for the drive.

18. Nick sketches the graph of   (1)
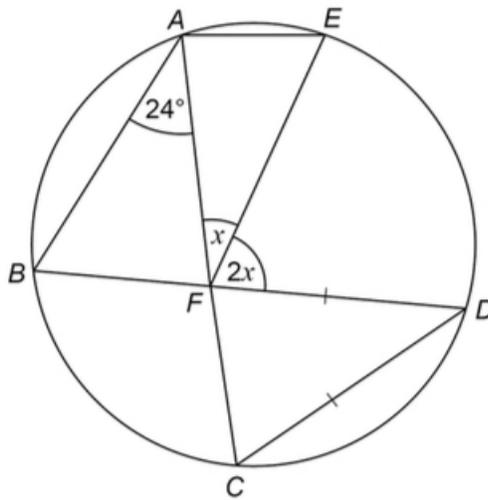$$y = 0.5^x \text{ for } x \geqslant 0.$$

Make **one** criticism of his sketch.

19. A, B, C, D, and E are points on a circle.   (4)
BFD and AFC are straight lines.
$DC = DF$.

Not drawn
accurately

Work out the size of angle x.
You **must** show your working which may be on the diagram.

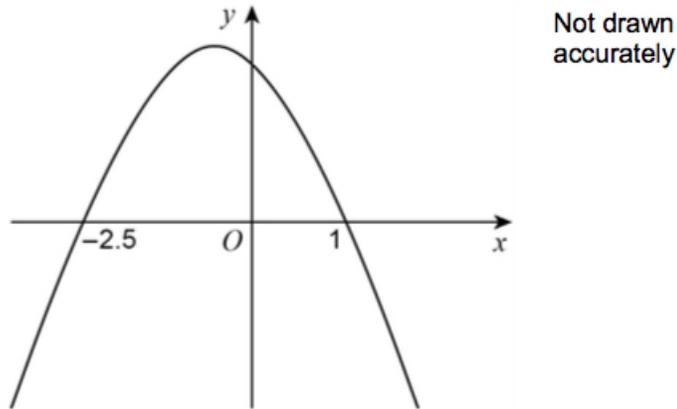20. This sign shows when a lift is safe to use.   (4)

Ben and some other people are in the lift.
Their total mass is 525 kg to the nearest 5 kg.

Ben gets out.
He has a mass of 78 kg to the nearest kg.

Is the lift now safe to use?
You **must** show your working.

21. Here is a sketch of $y = f(x)$ where $f(x)$ is a quadratic function. (1)

Not drawn accurately

The graph intersects the x-axis where $x = -2.5$ and $x = 1$.

Circle the solution of $f(x) > 0$.

$x < -2.5$ or $x > 1$ $-2.5 < x < 1$ $x > -2.5$ or $x > 1$ $x > -2.5$ or $x < 1$

22. Work out an expression for the nth term of the quadratic sequence (3)

$$2 \quad 17 \quad 40 \quad 71 \quad \ldots$$

Give your answer in the form
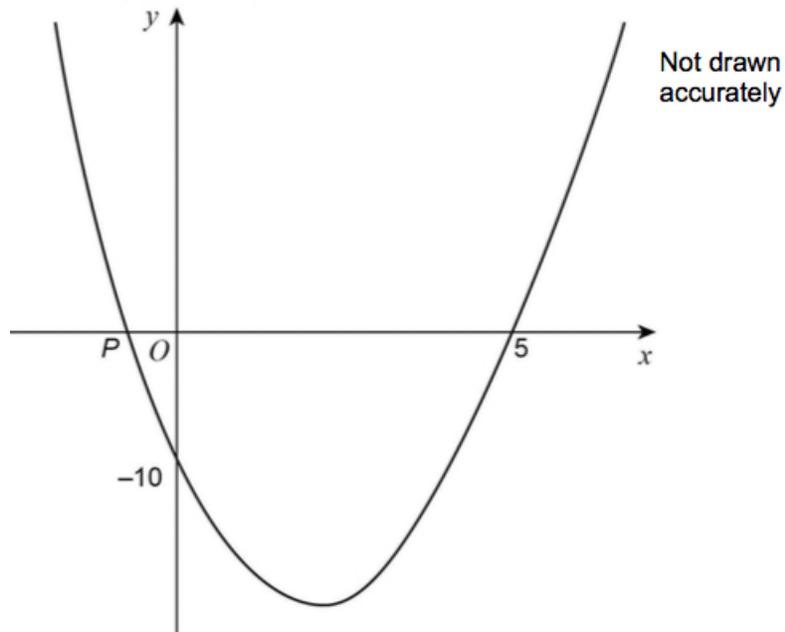$$an^2 + bn + c,$$
where a, b, and c are constants.

8

23. Here is a sketch of (4)
$$y = x^2 + bx + c.$$

The curve intersects

- the x-axis at $(5, 0)$ and point P and
- the y-axis at $(0, -10)$.
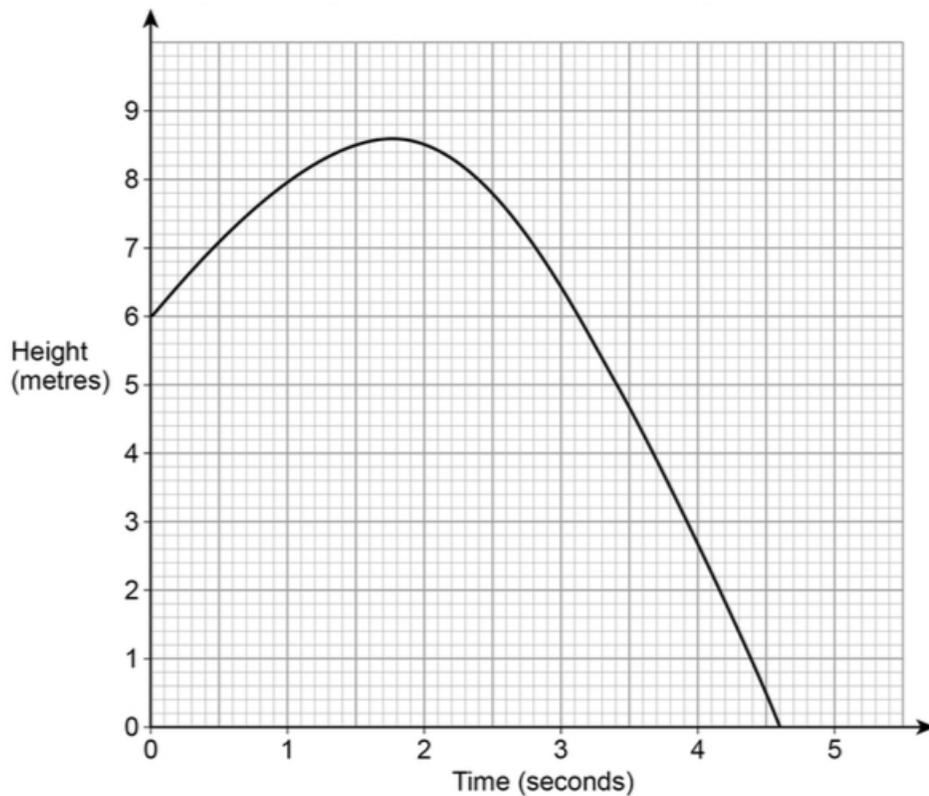

Not drawn accurately

Work out the x-coordinate of the turning point of the graph.

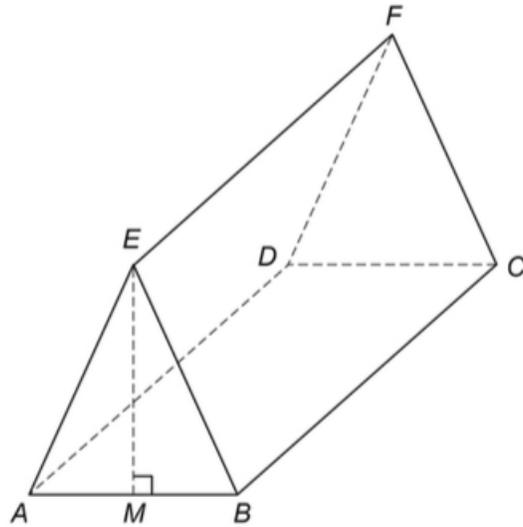24. A ball is thrown from a point 6 metres above the ground. (2)
The graph shows the height of the ball above the ground, in metres.

9

Estimate the speed of the ball, in m/s, after 1 second.
You **must** show your working.

25. Rectangle $ABCD$ is the horizontal base of a triangular prism $ABCDEF$.

- $AE = BE$.
- E is vertically above M, the midpoint of AB.
- $AB = 16$ cm.
- $AE = 17$ cm.
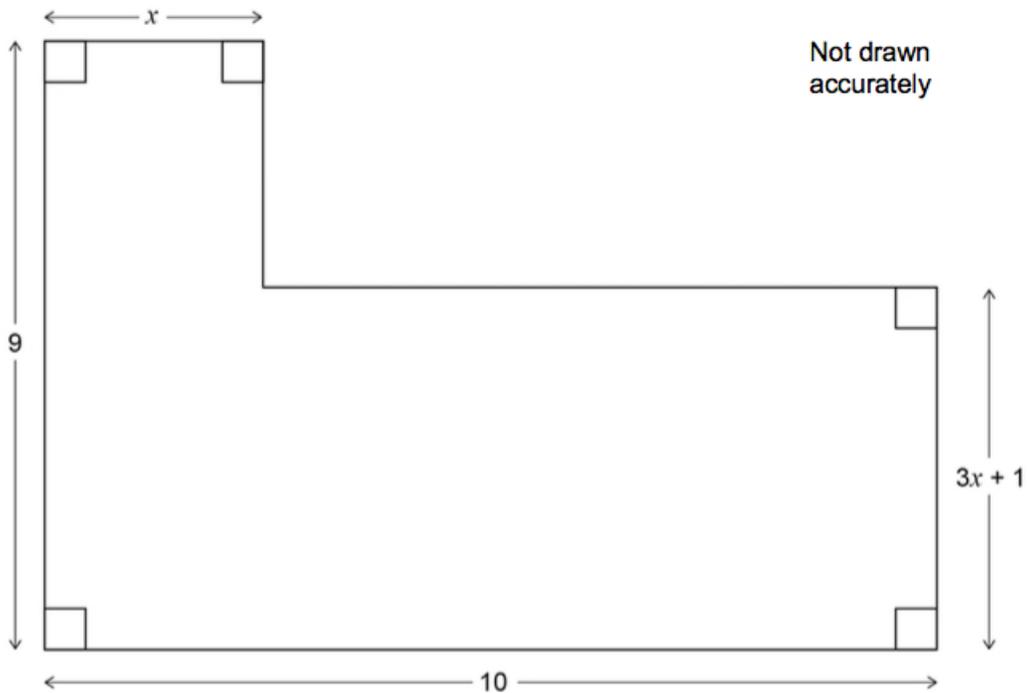- $BC = 30$ cm.

(a) Show that $EM = 15$ cm. (2)

(b) Work out the size of angle ECM. (4)

26. Here is an L-shape. (6)

All dimensions are in centimetres.

Not drawn accurately

The area of the L-shape is 65 cm^2.

Work out the value of x.

27. Prove that

$$x^2 + x + 1$$

is always positive.

(3)