

Dr Oliver Mathematics
GCSE Mathematics
2023 November Paper 2H: Calculator
1 hour 30 minutes

The total number of marks available is 80.

You must write down all the stages in your working.

1. (a) Expand and simplify (2)

$$3(2y - 5) + 7(y + 2).$$

- (b) Factorise fully (2)

$$6x^2 + 15x.$$

- (c) Make g the subject of the formula (2)

$$f = 3g + 11.$$

2. Karen is organising a party for a charity. (4)

She spends

- £100 on food,
- £120 on a hall, and
- £80 on a DJ.

Karen sells 54 tickets for the party.

Each ticket costs £7.50.

Work out the percentage profit Karen makes for the charity.

3. Andrew invests £4 500 in a savings account for 2 years. (2)

The account pays compound interest at a rate of 3.4% per year.

Calculate how much Andrew has in this savings account at the end of the 2 years.

4. Solve (3)

$$5x - 14 = 52 - x.$$

5. Chris, Debbie, and Errol share some money in the ratio 3 : 4 : 2. (4)

Debbie gets £120.

Chris then gives some of his share to Debbie and some of his share to Errol.

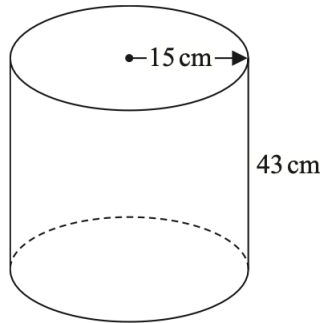
The money that Chris, Debbie and Errol each have is now in the ratio 2 : 5 : 3.

How much money did Chris give to Errol?

6. The bearing of port B from port A is 147° . (2)

Work out the bearing of port A from port B .

7. The diagram shows an empty tank in the shape of a cylinder. (4)



The cylinder has radius 15 cm and height 43 cm.

Water flows into the tank at a rate of 0.47 litres per minute.

Calculate the number of minutes it will take to completely fill the tank.

Give your answer correct to the nearest minute.

8. A number x is written correct to 2 significant figures. (2)

The result is 1.9.

Complete the error interval for x .

..... $\leq x <$

9. Expand and simplify (3)

$$(x + 7)(x - 2)(x + 3).$$

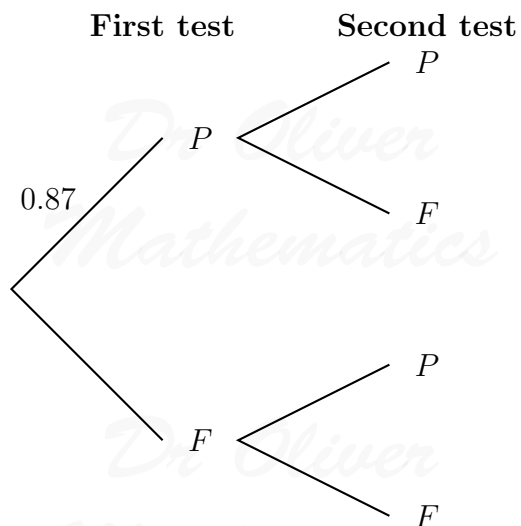
10. Shakir has to complete two tests.
He can either pass or fail each test.

The probability that he will pass the first test is 0.87.

If he passes the first test the probability he will pass the second test is 0.94.
 If he fails the first test the probability he will pass the second test is 0.73

(a) Complete the probability tree diagram for this information.

(2)

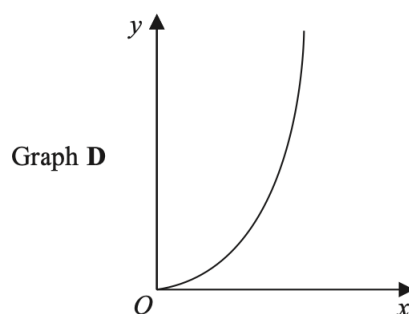
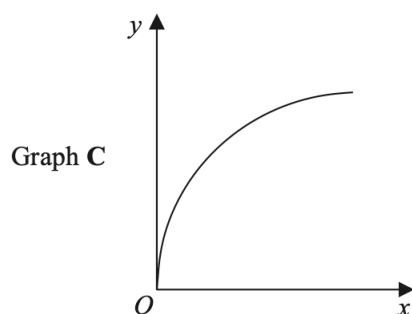
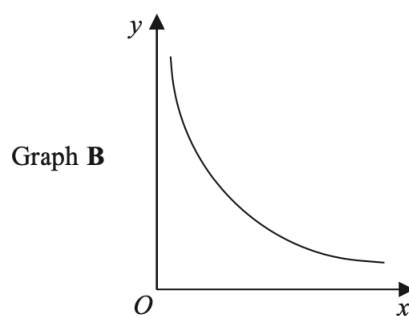
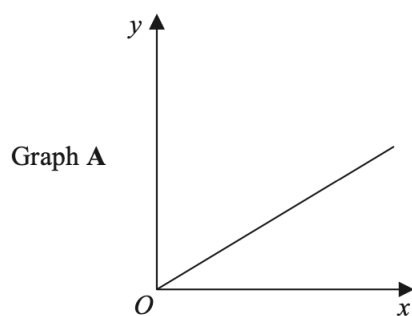


(b) Work out the probability that Shakir passes at least one of the tests.

(3)

11. The graphs of y against x represent four different types of proportionality.

(2)



Match each type of proportionality in the table to the correct graph.

Proportionality	Graph
$y \propto x^2$	
$y \propto x$	
$y \propto \frac{1}{x}$	
$y \propto \sqrt{x}$	

12. A is the point with coordinates $(7, 13)$. (3)
 B is the point with coordinates $(-3, 21)$.
 C is the point with coordinates $(15, 23)$.

M is the midpoint of AB .

N is the midpoint of BC .

Work out the distance between M and N .

Give your answer correct to 1 decimal place.

13. Prove algebraically that $0.0\dot{7}2\dot{3}$ can be written as $\frac{241}{3330}$. (3)

14. y is proportional to x^2 . (5)
 $y = 3$ when $x = 0.5$.

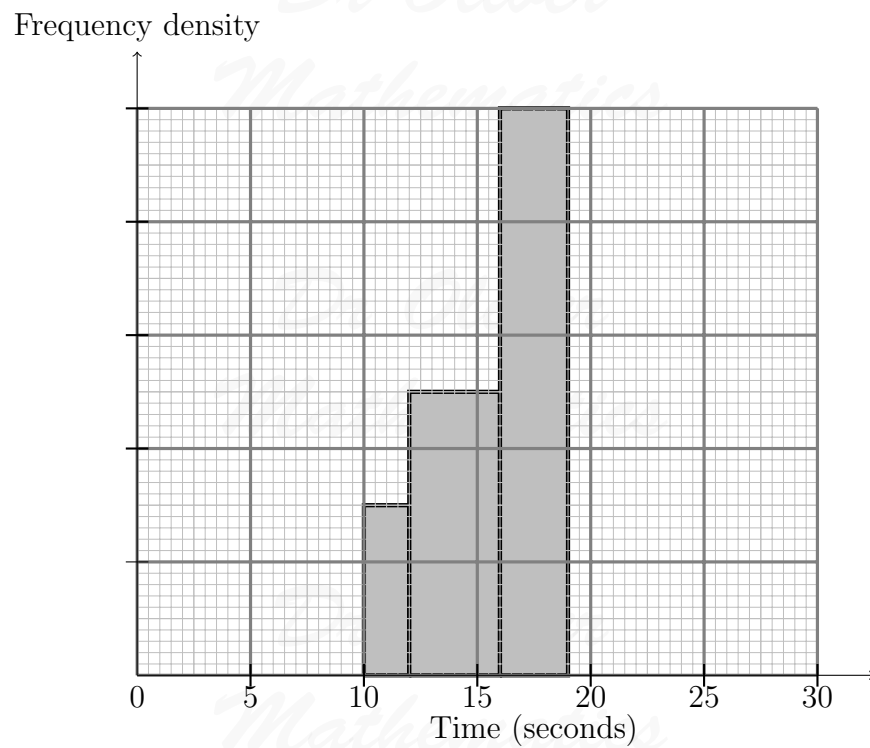
x is inversely proportional to w .

$x = 2$ when $w = 0.2$.

Find the value of y when $w = 2$.

15. The incomplete table and the incomplete histogram give information about the times taken by some students to run a race.

Time (t seconds)	Frequency
$10 < t \leq 12$	
$12 < t \leq 16$	10
$16 < t \leq 19$	15
$19 < t \leq 21$	9
$21 < t \leq 26$	7



None of these students had a time for the race such that $t \leq 10$ or $t > 26$.

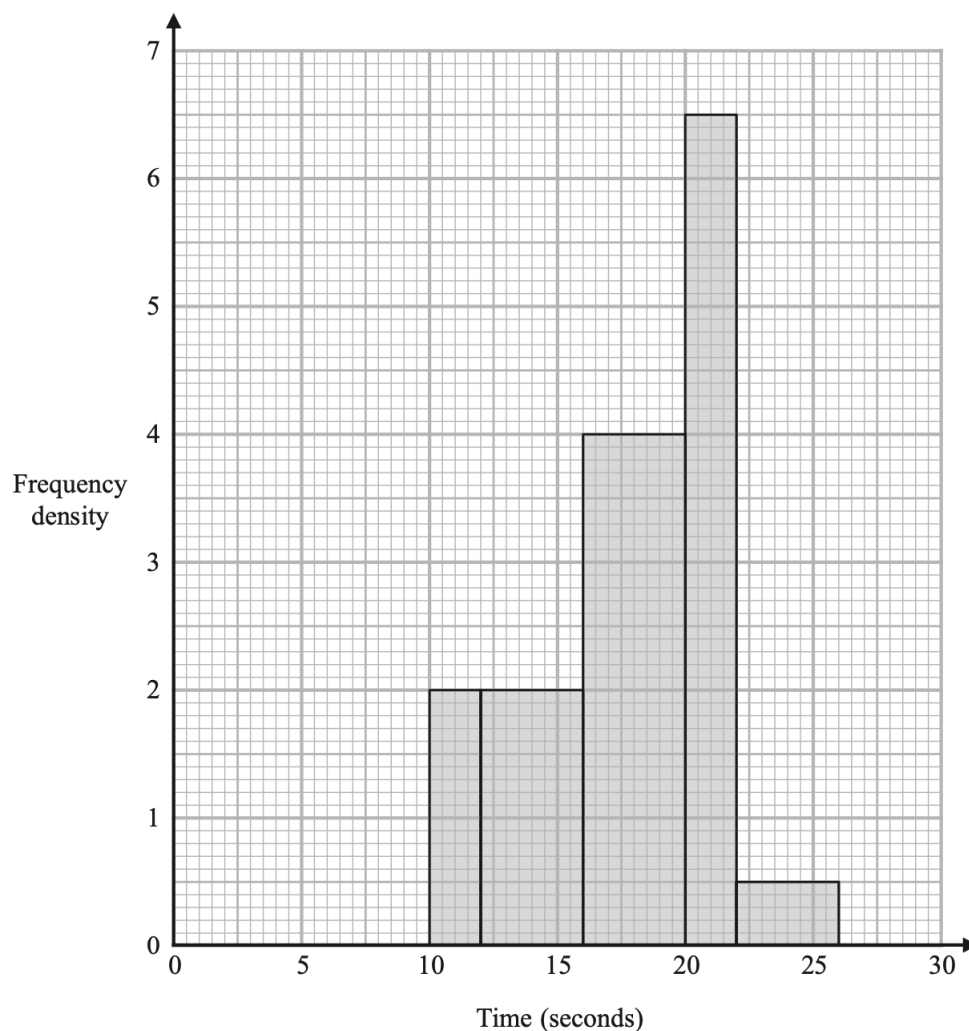
(a) Use the histogram to complete the table.

(1)

(b) Use the table to complete the histogram.

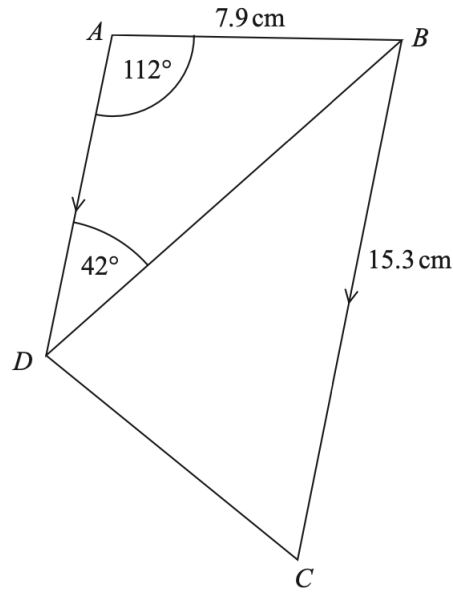
(2)

The histogram below gives information about the times taken by 43 students to run a different race.



- (c) Work out an estimate for the median of the times taken by these 43 students to run the race. (3)

16. $ABCD$ is a trapezium. (4)



AD is parallel to BC .

Calculate the area of triangle BCD .

Give your answer correct to 1 decimal place.

17. (a) Show that the equation (2)

$$x^3 + 2x - 6 = 0$$

has a solution between $x = 1$ and $x = 2$.

- (b) Show that the equation (1)

$$x^3 + 2x - 6 = 0$$

can be rearranged to give

$$x = \frac{6}{x^2 + 2}.$$

- (c) Starting with $x_0 = 1.45$, use the iteration formula (3)

$$x_{n+1} = \frac{6}{x_n^2 + 2}$$

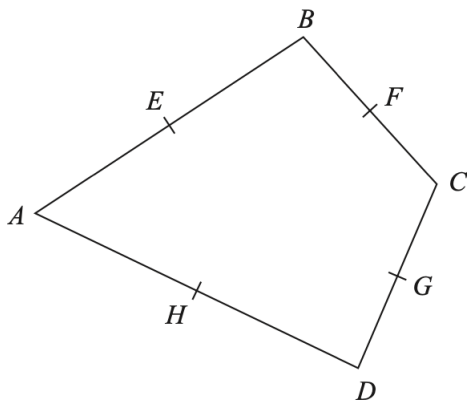
twice to find an estimate for the solution of

$$x^3 + 2x - 6 = 0.$$

Give your answer correct to 4 decimal places.

18. $ABCD$ is a quadrilateral.

(4)



- $E, F, G,$ and H are the midpoints of $AB, BC, CD,$ and DA .
- $\overrightarrow{AH} = \mathbf{a}.$
- $\overrightarrow{AE} = \mathbf{b}.$
- $\overrightarrow{DG} = \mathbf{c}.$

Prove, using vectors, that $EFGH$ is a parallelogram.

19. The functions f and g are such that

$$f(x) = (2x + 3)^2 \text{ and } g(x) = 2x - 1.$$

(a) Find $gf(-3).$

(2)

(b) Find $g^{-1}(x).$

(2)

20. Write

(4)

$$\frac{14}{3x - 21} + \left[(x + 4) \div \frac{2x^2 - 6x - 56}{2x + 3} \right]$$

in the form

$$\frac{ax + d}{cx + d},$$

where $a, b, c,$ and d are integers.

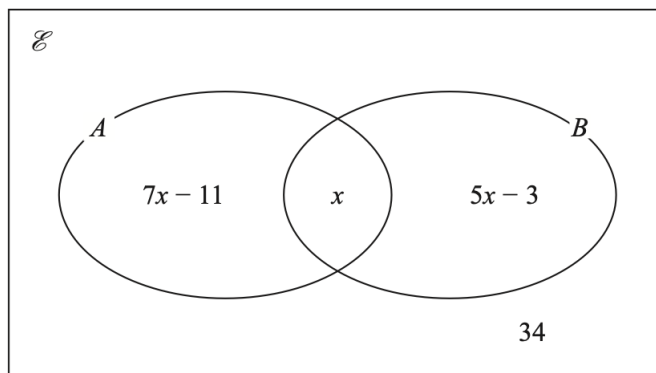
21. Vicky has a collection of medals.

(4)

The Venn diagram gives information about the number of medals in her collection where

- $\mathcal{E} = \{\text{all medals}\},$
- $A = \{\text{English medals}\},$ and

- $B = \{\text{gold medals}\}$.



Vicky is going to take at random a medal from her collection.

Given that the medal is gold, the probability that the medal is English is $\frac{2}{11}$.

Work out the number of medals in Vicky's collection.