

Dr Oliver Mathematics
GCSE Mathematics
2018 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. (a) Write (1)

$$7\,357$$

correct to 3 significant figures.

- (b) Work out (2)

$$\frac{\sqrt{17 + 4^2}}{7.3^2}$$

Write down all the figures on your calculator display.

2. Last year Jo paid £245 for her car insurance. (3)

This year she has to pay £883 for her car insurance.

Work out the percentage increase in the cost of her car insurance.

3. (a) Complete this table of values for (2)

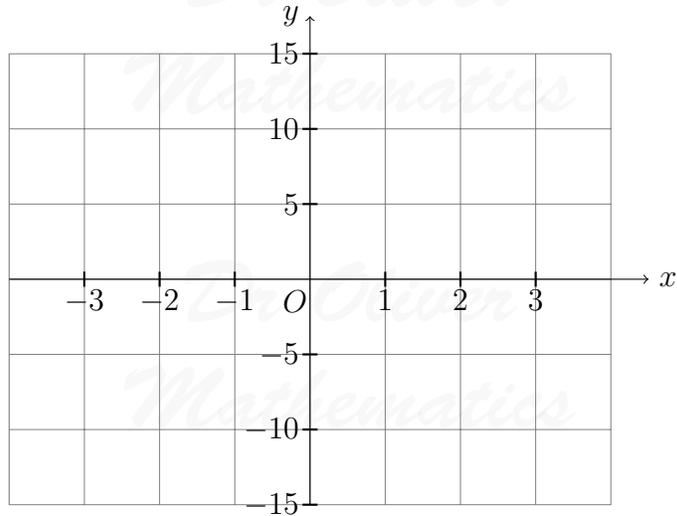
$$y = x^2 + x - 4.$$

x	-3	-2	-1	0	1	2	3
y		-2	-4		-2		

- (b) On the grid, draw the graph of (2)

$$y = x^2 + x - 4$$

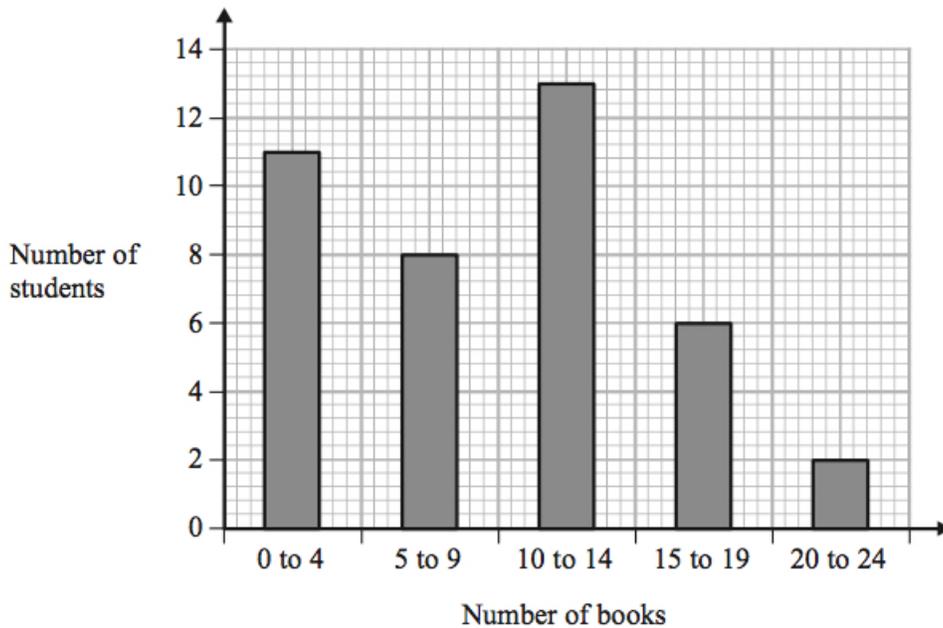
for values of x from -3 to 3.



(c) Use the graph to estimate a solution to $x^2 + x - 4 = 0$. (1)

4. Fran asks each of 40 students how many books they bought last year.

The chart below shows information about the number of books bought by each of the 40 students.



(a) Work out the percentage of these students who bought 20 or more books. (2)

- (b) Show that an estimate for the mean number of books bought is 9.5. (4)
You must show all your working.

5. Lara is a skier.

She completed a ski race in 1 minute 54 seconds.
The race was 475 m in length.

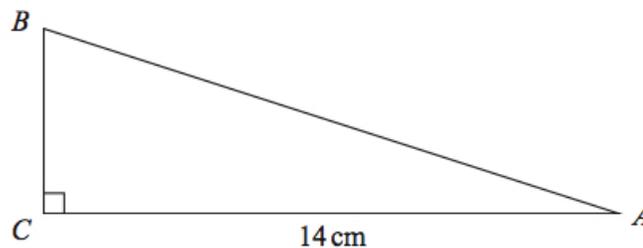
Lara assumes that her average speed is the same for each race.

- (a) Using this assumption, work out how long Lara should take to complete a 700 m race. (3)
Give your answer in minutes and seconds.

Lara's average speed actually increases the further she goes.

- (b) How does this affect your answer to part (a)? (1)

6. ABC is a right-angled triangle. (4)



$AC = 14$ cm.

Angle $C = 90^\circ$.

Size of angle B : size of angle $A = 3 : 2$.

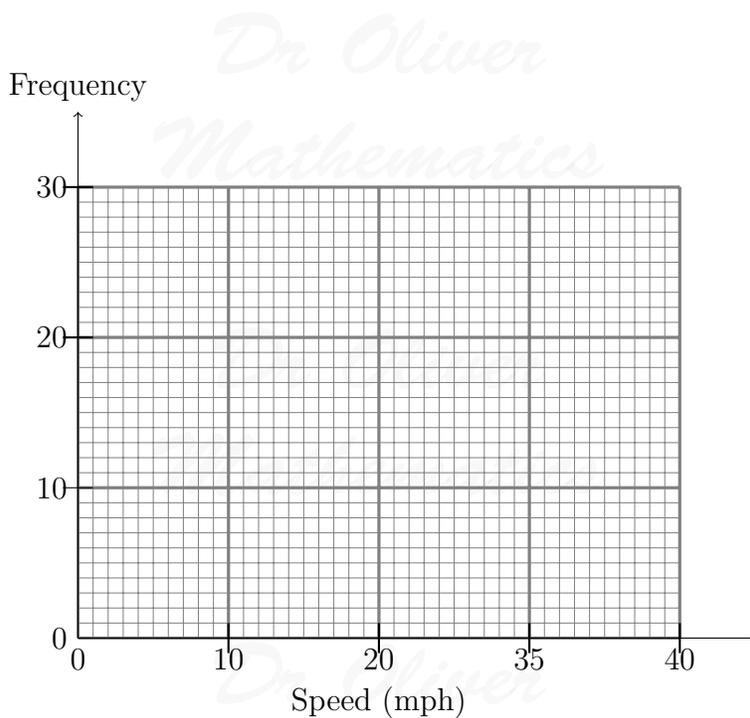
Work out the length of AB .

Give your answer correct to 3 significant figures.

7. The table gives information about the speeds of 70 cars. (2)

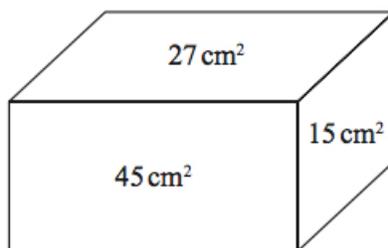
Speed, s mph	Frequency
$0 < s \leq 10$	14
$10 < s \leq 20$	18
$20 < s \leq 30$	26
$30 < s \leq 40$	12

Draw a frequency polygon for this information.



8. The diagram shows a solid metal cuboid. (5)

The areas of three of the faces are marked on the diagram.
 The lengths, in cm, of the edges of the cuboid are whole numbers.



The metal cuboid is melted and made into cubes.
 Each of the cubes has sides of length 2.5 cm.

Work out the greatest number of these cubes that can be made.

9. (a) Expand and simplify (3)

$$(x - 2)(2x + 3)(x + 1).$$

$$\frac{y^4 \times y^n}{y^2} = y^{-3}.$$

(b) Find the value of n . (2)

(c) Solve (3)

$$5x^2 - 4x - 3 = 0.$$

Give your solutions correct to 3 significant figures.

10.

$$f(x) = 4 \sin x^\circ.$$

(a) Find $f(23)$. (1)

Give your answer correct to 3 significant figures.

$$g(x) = 2x - 3.$$

(b) Find $f g(34)$. (2)

Give your answer correct to 3 significant figures.

$$h(x) = (x + 4)^2.$$

Ivan needs to solve the following equation

$$h(x) = 25.$$

He writes

$$(x + 4)^2 = 25$$

$$x + 4 = 5$$

$$x = 1.$$

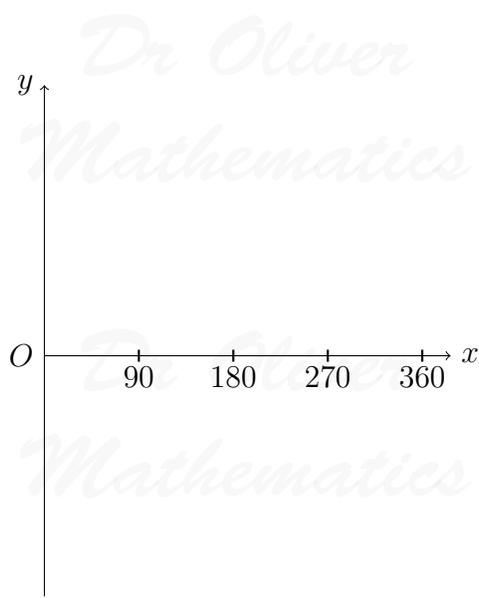
This is not fully correct.

(c) Explain why. (1)

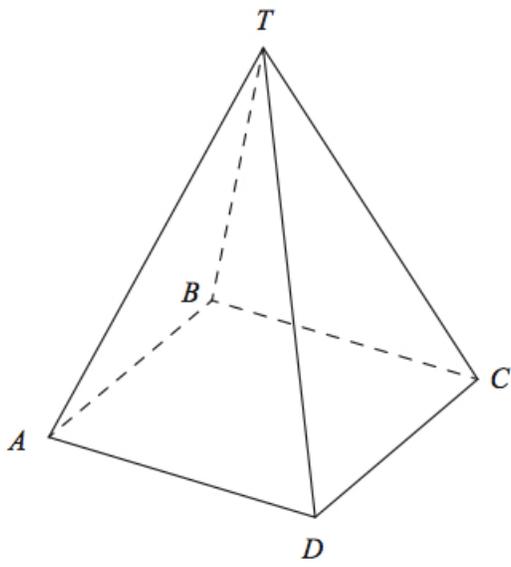
11. Sketch the graph of (2)

$$y = \tan x^\circ,$$

for $0 \leq x \leq 360$.



12. Here is a pyramid with a square base $ABCD$. (4)



$AB = 5$ m.

The vertex T is 12 m vertically above the midpoint of AC .

Calculate the size of angle TAC .

13. The number of animals in a population at the start of year t is P_t . (2)
 The number of animals at the start of year 1 is 400.

Given that

$$P_{t+1} = 1.01P_t,$$

work out the number of animals at the start of year 3.

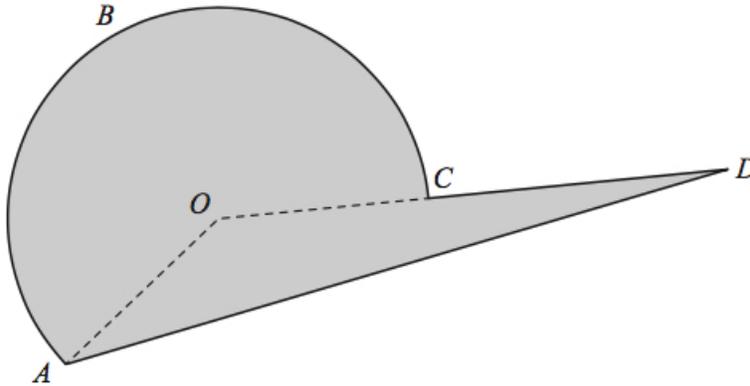
14. y is inversely proportional to x^3 . (3)

$$y = 44 \text{ when } x = a.$$

Show that $y = 5.5$ when $x = 2a$.

15. Prove algebraically that the difference between the squares of any two consecutive odd numbers is always a multiple of 8. (3)

16. Here is a shaded shape $ABCD$. (5)



The shape is made from a triangle and a sector of a circle, centre O , and radius 6 cm.

OCD is a straight line.

$$AD = 14 \text{ cm.}$$

$$\text{Angle } AOD = 140^\circ.$$

$$\text{Angle } OAD = 24^\circ.$$

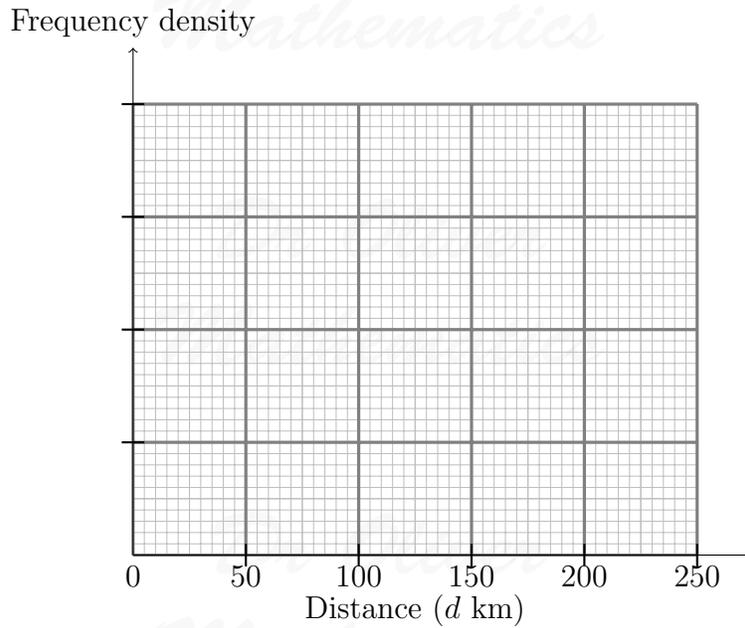
Calculate the perimeter of the shape.

Give your answer correct to 3 significant figures.

17. The table shows information about the distances 570 students travelled to a university open day.

Distance (d km)	Frequency
$0 < d \leq 20$	120
$20 < d \leq 50$	90
$50 < d \leq 80$	120
$80 < d \leq 150$	140
$150 < d \leq 200$	100

- (a) Draw a histogram for the information in the table. (3)



- (b) Estimate the median distance. (2)

18. A high speed train travels a distance of 487 km in 3 hours. (5)

The distance is measured correct to the nearest kilometre.

The time is measured correct to the nearest minute.

By considering bounds, work out the average speed, in km/minute, of the train to a suitable degree of accuracy.

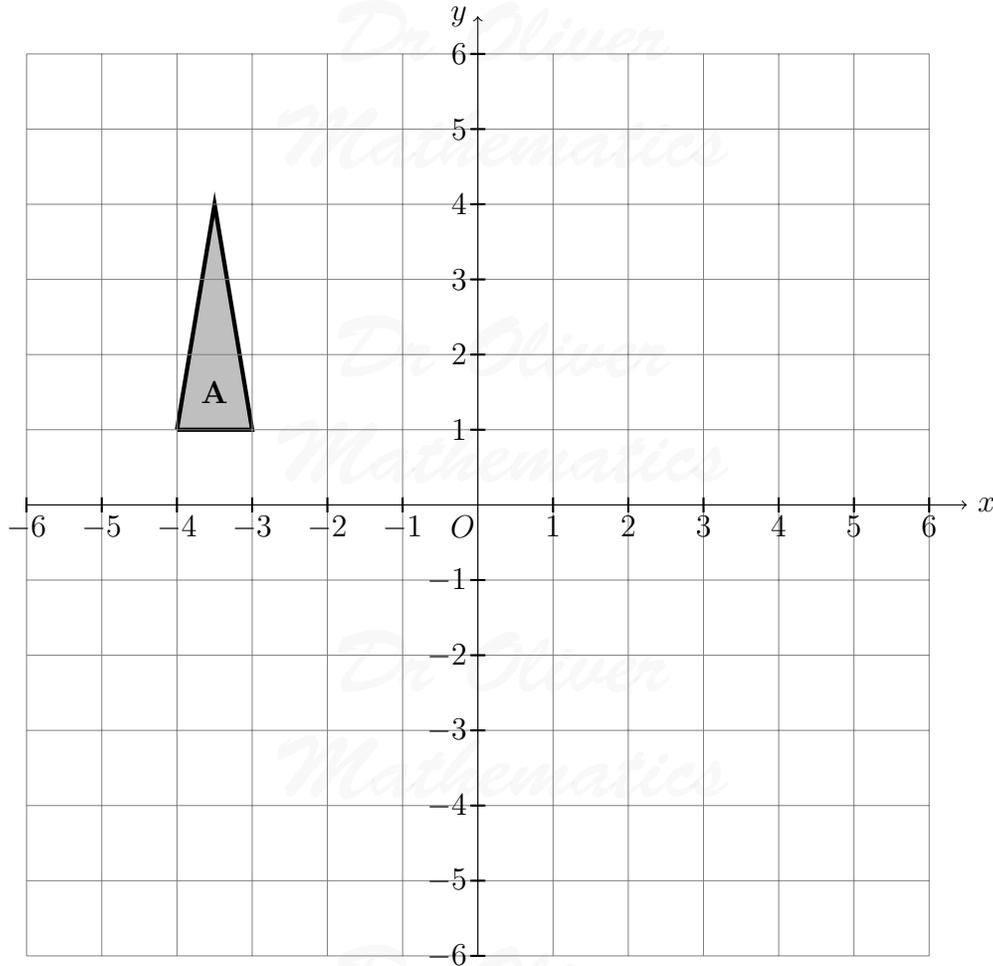
You must show all your working and give a reason for your answer.

19. Solve algebraically the simultaneous equations: (5)

$$\begin{aligned} 2x^2 - y^2 &= 17 \\ x + 2y &= 1. \end{aligned}$$

20. Triangle **A** is transformed by the combined transformation of a rotation of 180° about the point $(-2, 0)$ followed by a translation with vector

$$\begin{pmatrix} -3 \\ 2 \end{pmatrix}.$$



One point on triangle **A** is invariant under the combined transformation. Find the coordinates of this point.