

**Dr Oliver Mathematics**  
**GCSE Mathematics**  
**2019 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) Expand and simplify (2)

$$(x + 5)(x - 9).$$

- (b) Factorise fully (2)

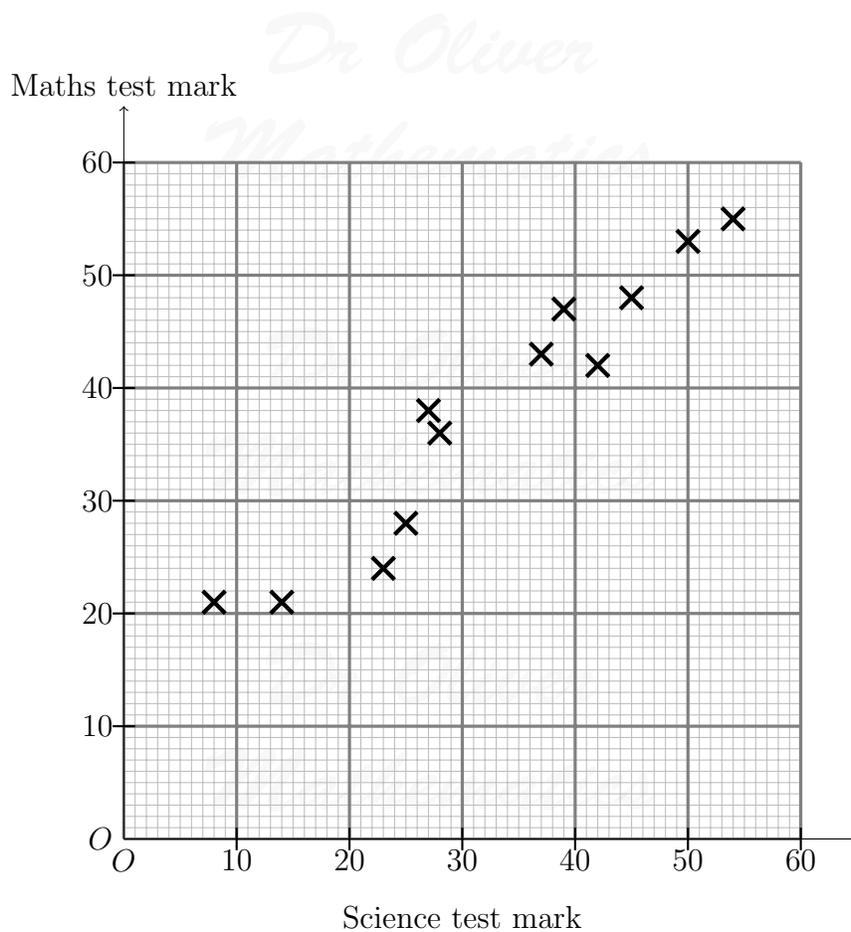
$$9x^2 + 6x.$$

2. (a) Use your calculator to work out (2)

$$\frac{29^2 - 4.6}{\sqrt{35 - 1.9^3}}.$$

Write down all the figures on your calculator display.

- (b) Write your answer to part (a) correct to 4 significant figures. (1)
3. The scatter graph shows information about the marks a group of students got in a Science test and in a Maths test. (2)



Jamie got a mark of 34 in the Science test.

Using the scatter graph, find an estimate for Jamie's mark in the Maths test.

4. The table gives information about the times taken, in seconds, by 18 students to run a race. (3)

Time ( $t$ seconds)	Frequency
$5 < t \leq 10$	1
$10 < t \leq 15$	2
$15 < t \leq 20$	7
$20 < t \leq 25$	8

Work out an estimate for the mean time.  
Give your answer correct to 3 significant figures.

5. Write  $37 \text{ cm}^3$  in  $\text{mm}^3$ . (1)

6. Nimer was driving to a hotel. (4)  
He looked at his Sat Nav at 13 30.

Time	13 30
Distance to destination	65 miles

Nimer arrived at the hotel at 14 48.

Work out the average speed of the car from 13 30 to 14 48.  
You must show all your working.

7. (a) Write (1)

32 460 000

in standard form.

- (b) Write (1)

$4.96 \times 10^{-3}$

as an ordinary number.

Asma was asked to compare the following two numbers:

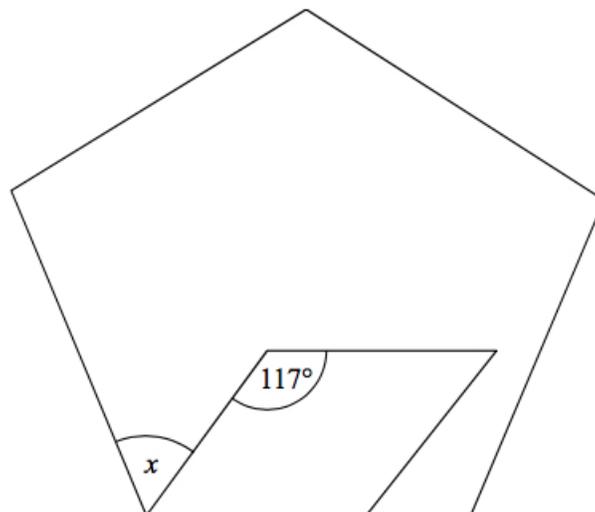
$$A = 6.212 \times 10^8 \text{ and } B = 4.73 \times 10^9.$$

She says, "6.212 is bigger than 4.73 so  $A$  is bigger than  $B$ ."

- (c) Is Asma correct? (1)

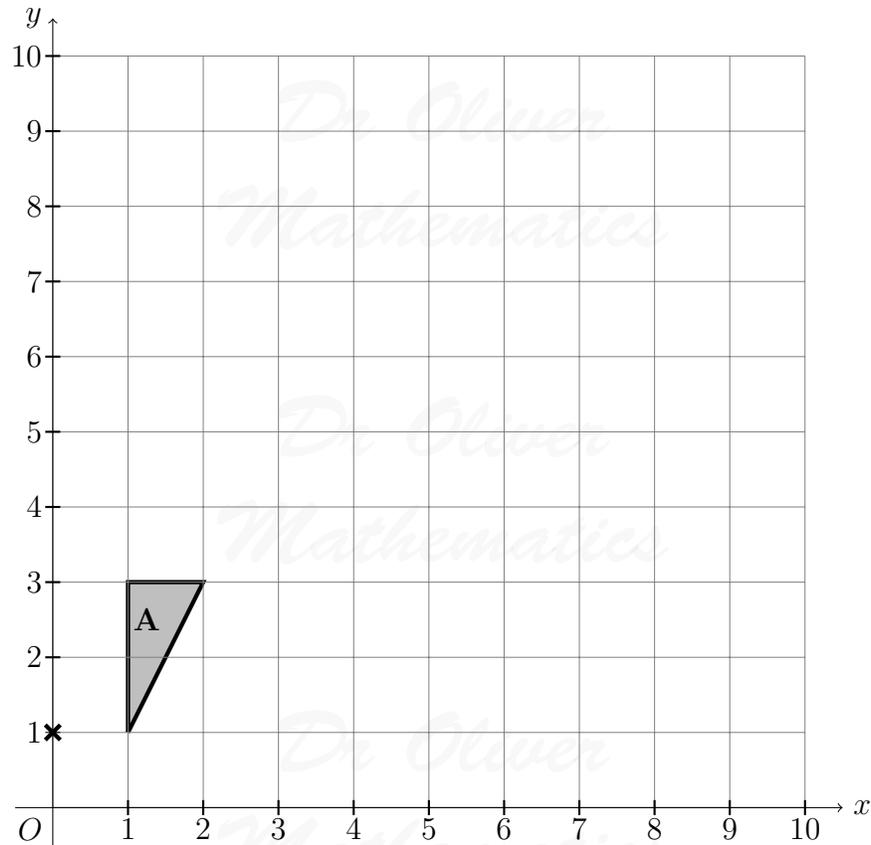
You must give a reason for your answer.

8. The diagram shows a regular pentagon and a parallelogram. (4)



Work out the size of the angle marked  $x$ .  
You must show all your working.

9. Enlarge triangle **A** by scale factor 2.5 with centre  $(0, 1)$ . (2)



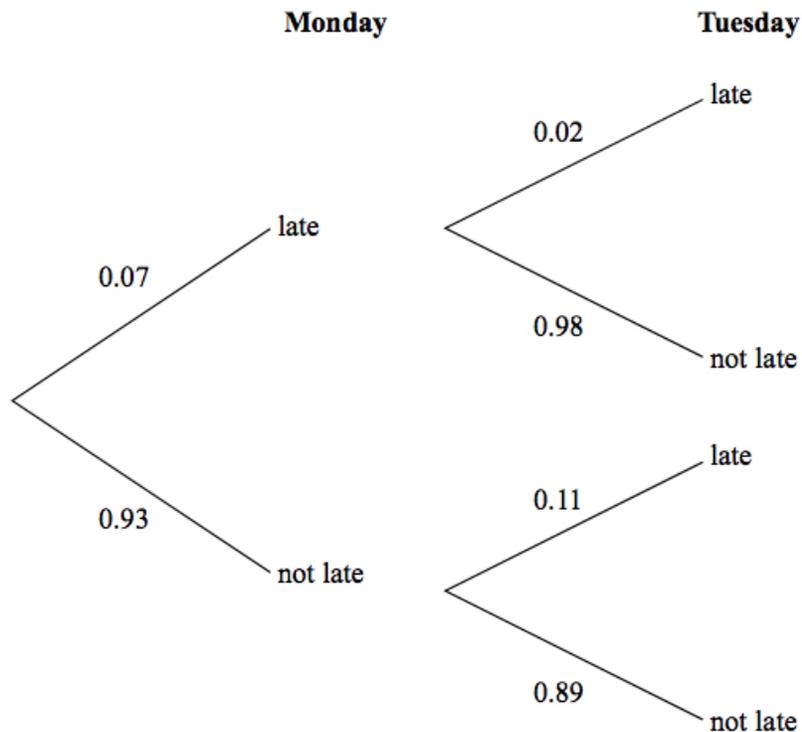
10. (a) Solve (3)

$$\frac{9 + x}{7} = 11 - x.$$

- (b) Simplify (1)

$$\frac{4(y + 3)^3}{(y + 3)^2}.$$

11. The probability tree diagram shows the probabilities that Bismah will be late for work on two days next week. (3)



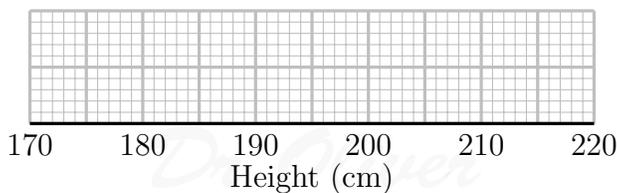
Calculate the probability that Bismah will be late on exactly one of the two days.

12. The stem and leaf diagram shows information about the heights, in cm, of 23 sunflowers. (3)

17	3	4	9				
18	6	8	8				
19	0	0	1	4	6	7	8
20	1	4	7	7	9	9	
21	4	8	8	9			

Key: 17|3 represents 173 cm

On the grid, draw a box plot for this information.



13. Liquid  $A$  and liquid  $B$  are mixed together in the ratio  $2 : 13$  by volume to make liquid  $C$ . (4)

Liquid  $A$  has density  $1.21 \text{ g/cm}^3$ .  
Liquid  $B$  has density  $1.02 \text{ g/cm}^3$ .

A cylindrical container is filled completely with liquid  $C$ .  
The cylinder has radius  $3 \text{ cm}$  and height  $25 \text{ cm}$ .

Work out the mass of the liquid in the container.  
Give your answer correct to 3 significant figures.  
You must show all your working.

14. A group of people went to a restaurant. (4)  
Each person chose one starter and one main course.

Starter	Main Course
Soup	Lasagne
Prawns	Curry

The number of people who chose soup : the number of people who chose prawns =  $2 : 3$ .

Of those who chose soup,

the number of people who chose lasagne : the number of people who chose curry =  $5 : 3$ .

Of those who chose prawns,

the number of people who chose lasagne : the number of people who chose curry =  $1 : 5$ .

What fraction of the people chose curry?

You must show how you get your answer.

15. Prove algebraically that the sum of the squares of any two consecutive even numbers is always a multiple of 4. (3)

16.  $y$  is inversely proportional to the square of  $x$ . (3)

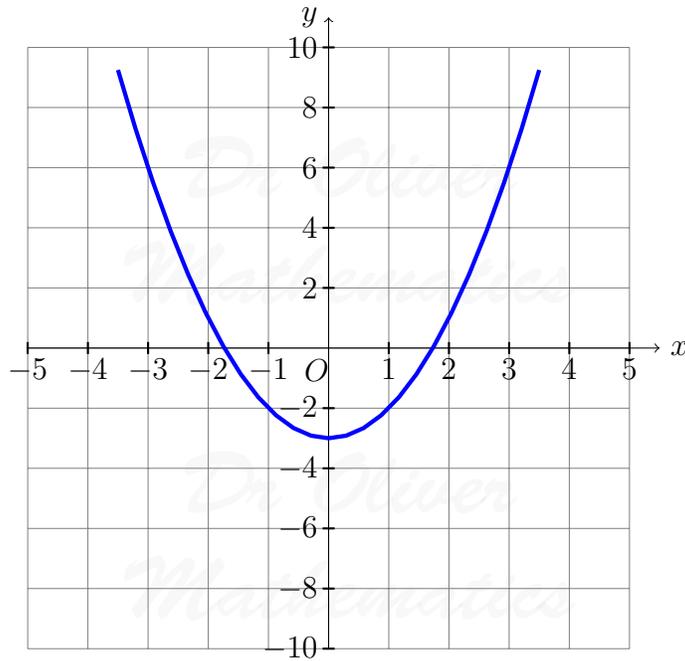
$y = 8$  when  $x = 2.5$ .

Find the negative value of  $x$  when  $y = \frac{8}{9}$ .

17. Here is the graph of

$$y = x^2 - 3.$$

(4)



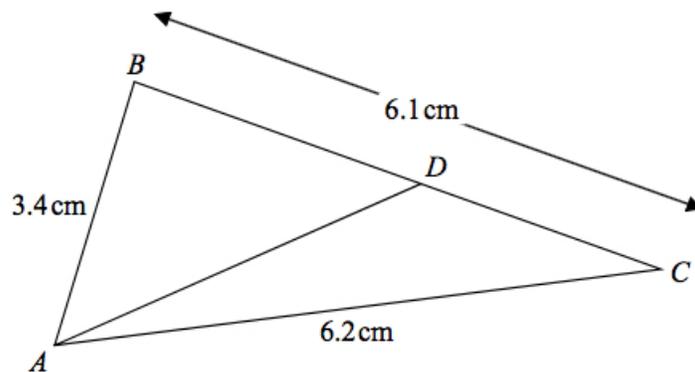
Use the graph to find estimates for the solutions to the equation

$$x^2 - 2x - 2 = 0.$$

You must show how you get your solutions.

18. The diagram shows triangle  $ABC$ .

(5)



$$AB = 3.4 \text{ cm.}$$

$$AC = 6.2 \text{ cm.}$$

$BC = 6.1$  cm.

$D$  is the point on  $BC$  such that

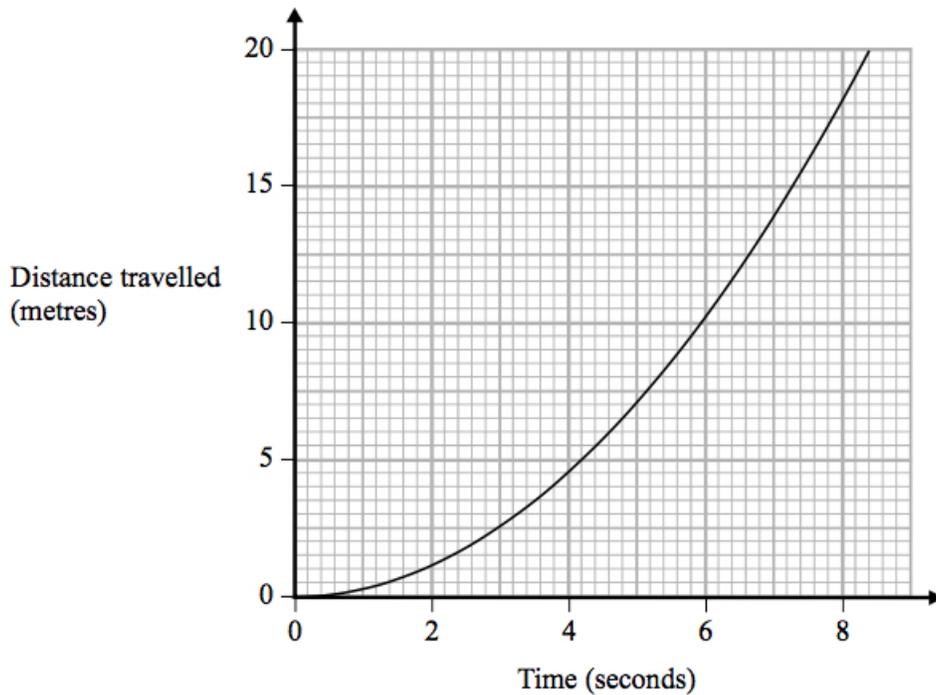
$$\text{size of angle } DAC = \frac{2}{5} \times \text{size of angle } BCA.$$

Calculate the length  $DC$ .

Give your answer correct to 3 significant figures.

You must show all your working.

19. The graph shows information about part of a cyclist's journey. (3)



Work out an estimate of the speed, in m/s, of the cyclist at time 6 seconds.

20. Here are the first five terms of a sequence: (2)

$-1$     $0$     $3$     $8$     $15$ .

Find an expression, in terms of  $n$ , for the  $n$ th term of this sequence.

21. When a biased coin is thrown 4 times, the probability of getting 4 heads is  $\frac{16}{81}$ . (2)

Work out the probability of getting 4 tails when the coin is thrown 4 times.

22. Show that

$$\frac{7x - 14}{x^2 + 4x - 12} \div \frac{x - 6}{x^3 - 36x}$$

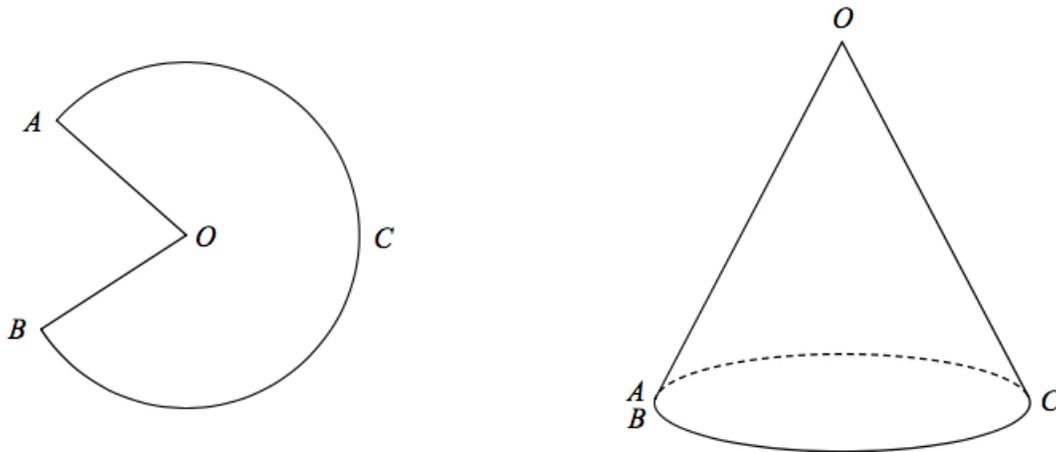
(4)

simplifies to  $ax$  where  $a$  is an integer.

23. The diagram shows a sector  $OACB$  of a circle with centre  $O$ .  
The point  $C$  is the midpoint of the arc  $AB$ .

(5)

The diagram also shows a hollow cone with vertex  $O$ .  
The cone is formed by joining  $OA$  and  $OB$ .

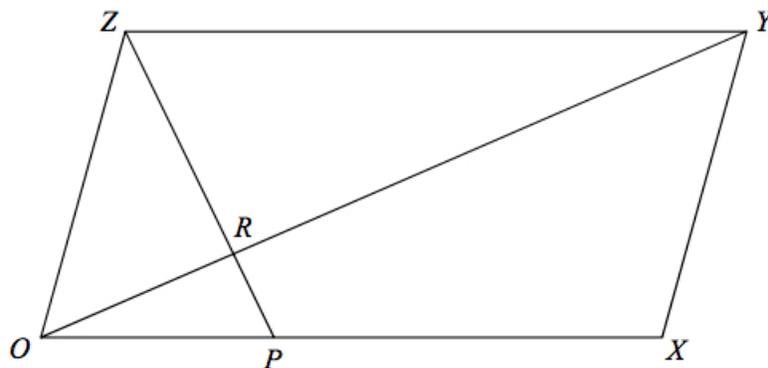


The cone has volume  $56.8 \text{ cm}^3$  and height  $3.6 \text{ cm}$ .

Calculate the size of angle  $AOB$  of sector  $OACB$ .  
Give your answer correct to 3 significant figures.  
You must show all your working.

24.  $OXYZ$  is a parallelogram.

(5)



$$\overrightarrow{OX} = \mathbf{a}.$$

$$\overrightarrow{OY} = \mathbf{b}.$$

$P$  is the point on  $OX$  such that  $OP : PX = 1 : 2$ .

$R$  is the point on  $OY$  such that  $OR : RY = 1 : 3$ .

Work out, in its simplest form, the ratio  $ZP : ZR$ .

You must show all your working.

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