

**Dr Oliver Mathematics**  
**GCSE Mathematics**  
**2017 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. Solve

$$5x - 6 = 3(x - 1).$$

(3)

2. Emily buys a pack of 12 bottles of water.

The pack costs £5.64.

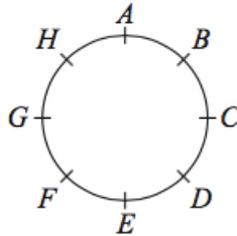
(3)

Emily sells all 12 bottles for 50p each.

Work out Emily's percentage profit.

Give your answer correct to 1 decimal place.

3. Hasmeet walks once round a circle with diameter 80 metres.

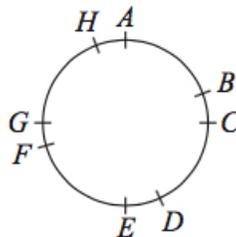


There are 8 points equally spaced on the circumference of the circle.

- (a) Find the distance Hasmeet walks between one point and the next point.

(2)

Four of the points are moved, as shown in the diagram below.



Hasmeet walks once round the circle again.

- (b) Has the mean distance that Hasmeet walks between one point and the next point changed? (1)

You must give a reason for your answer.

4. There are only blue cubes, yellow cubes, and green cubes in a bag. (3)

There are

twice as many blue cubes as yellow cubes

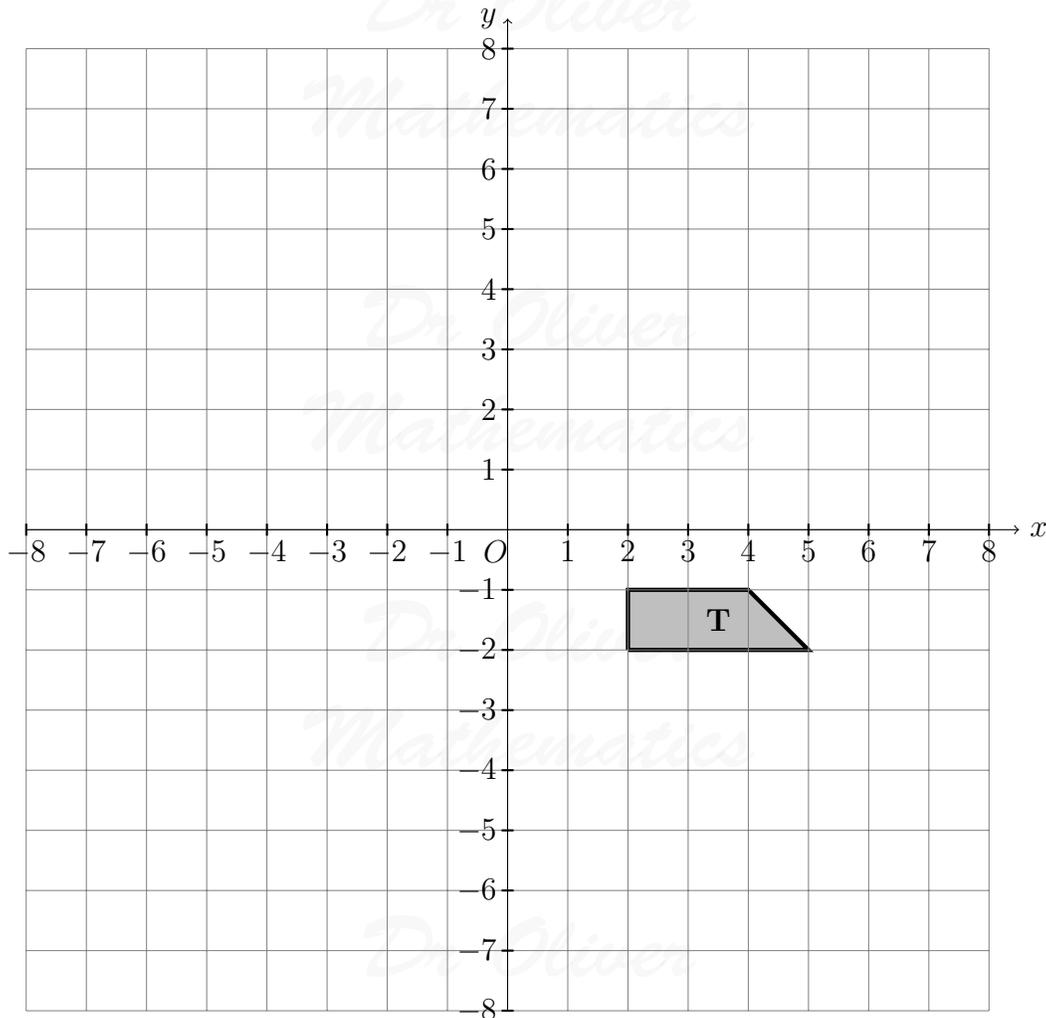
and

four times as many blue cubes as green cubes.

Hannah takes at random a cubes from the bag.

Work out the probability that Hannah takes a yellow cube.

5. Here is a picture.



- (a) Rotate  $\mathbf{T}$   $180^\circ$  about the origin.  
Label the new trapezium  $\mathbf{A}$ . (1)

- (b) Rotate  $\mathbf{T}$  by the vector  
$$\begin{pmatrix} -1 \\ -3 \end{pmatrix}.$$
 (1)

Label the new trapezium  $\mathbf{B}$ .

6.

$$p^3 \times p^x = p^9.$$

- (a) Find the value of  $x$ . (1)

$$(7^2)^y = 7^{10}.$$

- (b) Find the value of  $y$ . (1)

$$100^a \times 1\,000^b$$

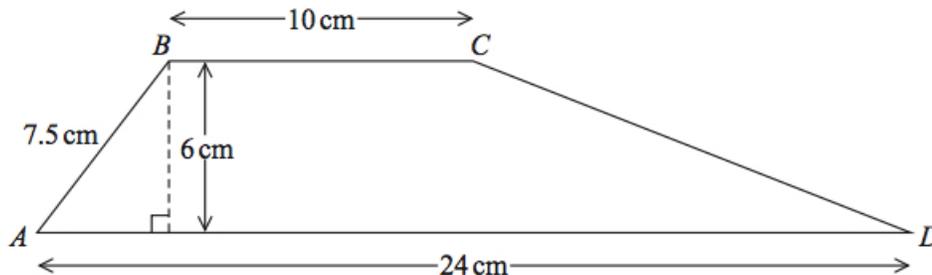
can be written in the form

$$10^w.$$

- (c) Show that (2)

$$w = 2a + 3b.$$

7.  $ABCD$  is trapezium. (5)



Work out the size of angle  $CDA$ .  
Give your answer correct to 1 decimal place.

8. Use your calculator to work out

$$\sqrt{\frac{\sin 25^\circ + \sin 40^\circ}{\cos 25^\circ - \cos 40^\circ}}.$$

- (a) Write down all the figures on your calculator display. (2)

(b) Write your answer to part (a) correct to 2 decimal places. (1)

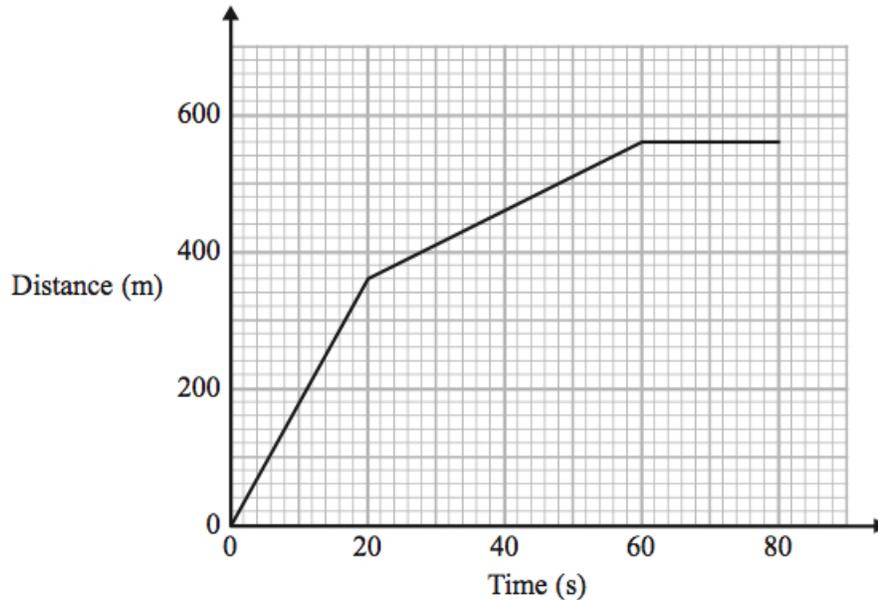
9. Yesterday, it took 5 cleaners  $4\frac{1}{2}$  hours to clean all the rooms in a hotel. (3)

There were only 3 cleaners to clean all the rooms in a hotel today.

Each cleaner is paid £8.20 for each hour or part of an hour they work.

How much will each cleaner be paid today?

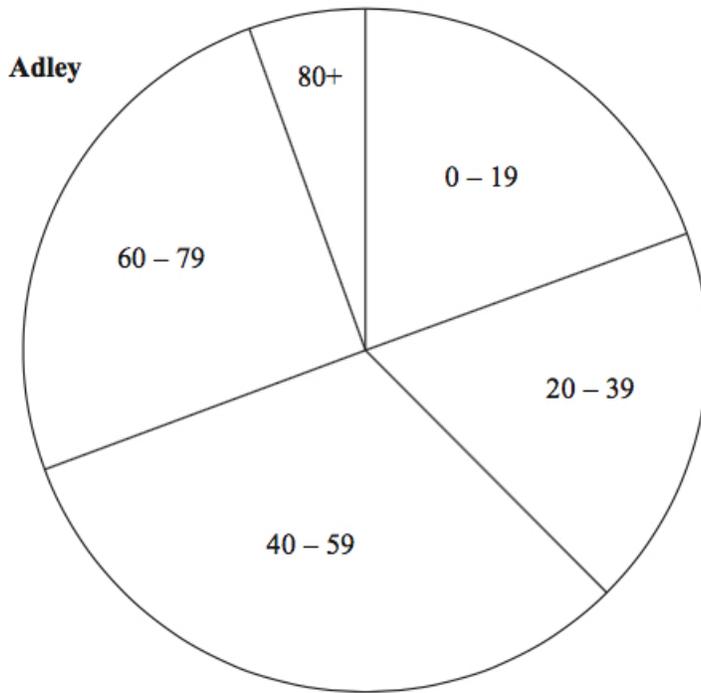
10. Here is part of a distance-time graph for a car's journey.



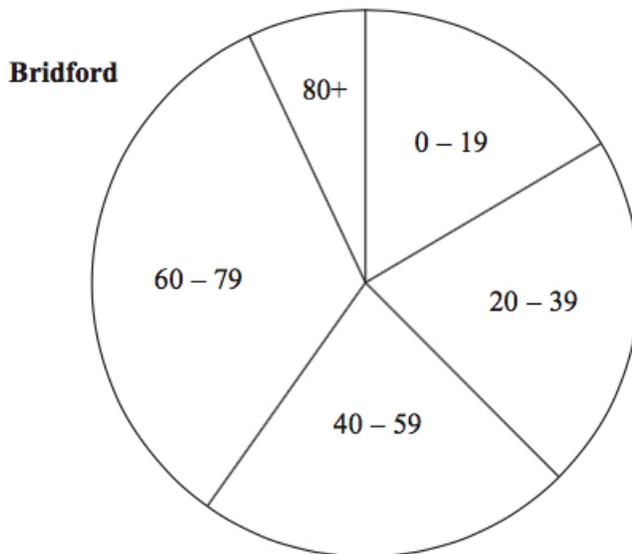
(a) Between which two times does the car travel at its greatest speed? (2)  
Give a reason for your answer.

(b) Work out this greatest speed. (1)

11. The pie charts give information about the ages, in years, of people living in two towns, Adley and Bridford. (3)



Diagrams accurately drawn



[Note: the radius of Adley's pie chart is 5 cm and the radius of Bridford's pie chart is 4 cm.]

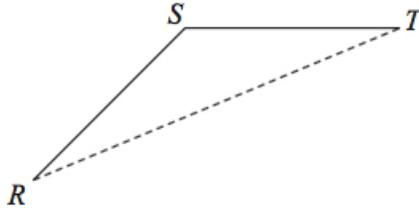
The ratio of the number of people living in Adley to the number of people living in

Bridford is given by the ratio of the areas of the pie charts.

What proportion of the total number of people living in these two towns live in Adley **and** are aged 0-19?

Give your answers correct to 3 significant figures.

12.  $RS$  and  $ST$  are 2 sides of a regular 12-sided polygon. (3)  
 $RT$  is a diagonal of the polygon.



Work out the size of angle  $STR$ .

You must show your working.

13. At the beginning of 2009, Mr Veale bought a company.  
The value of the company was £50 000.

Each year the value of the company increased by 2%.

- (a) Calculate the value of the company at the beginning of 2017. (2)  
Give your answer correct to the nearest £100.

At the beginning of 2009 the value of a different company was £250 000.  
In 6 years the value of the company increased to £320 000.

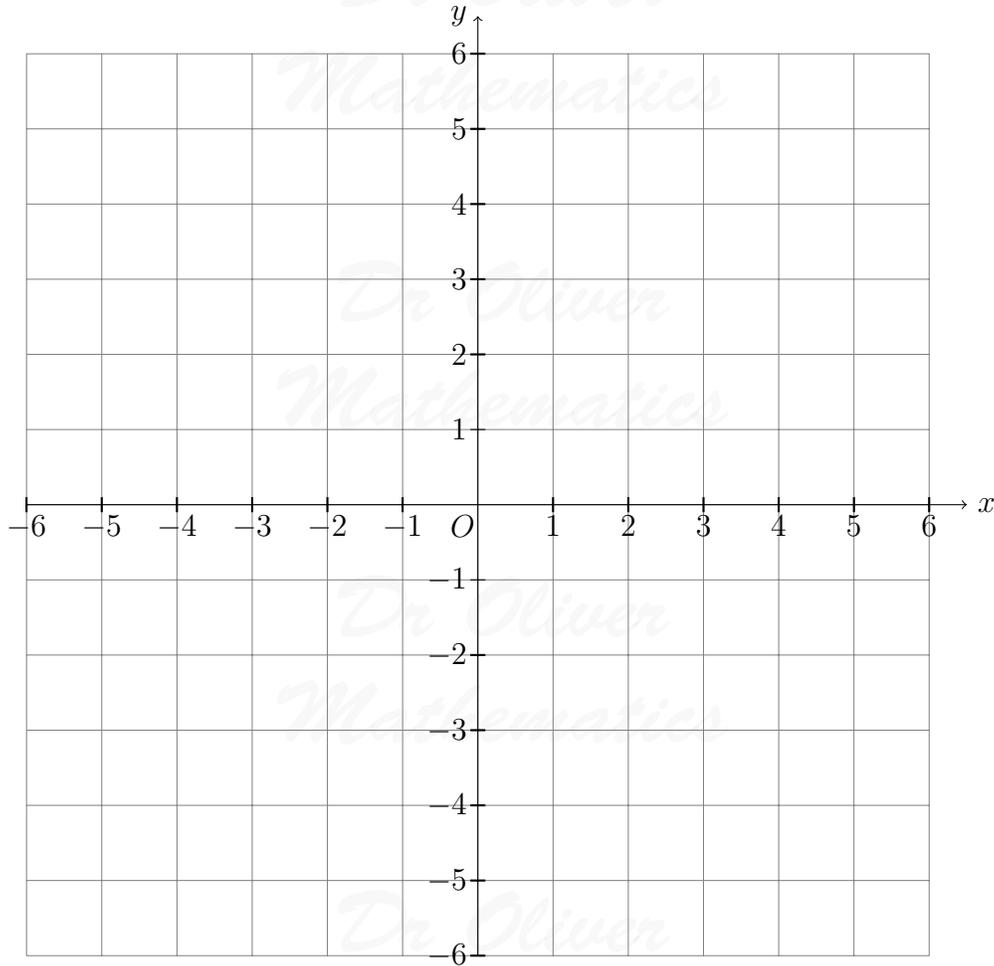
This is equivalent to an increase of  $x\%$  each year.

- (b) Find the value of  $x$ . (3)  
Give your answer correct to 2 significant figures.

14. On the grid, shade the region that satisfies all these inequalities. (3)

$$y > 1 \quad x + y < 5 \quad y > 2x.$$

Label the region **R**.



15. Tracey is going to choose a main course and a dessert in a cafe.  
She can choose from 8 main courses and 7 desserts.

Tracey says that to work out the number of different way of choosing a main course and a dessert you add 8 and 7.

- (a) Is Tracey correct? (1)  
You must give a reason for your answer.

12 teams play in a competition.  
Each team plays each other team exactly once.

- (b) Work out the total number of games played. (2)

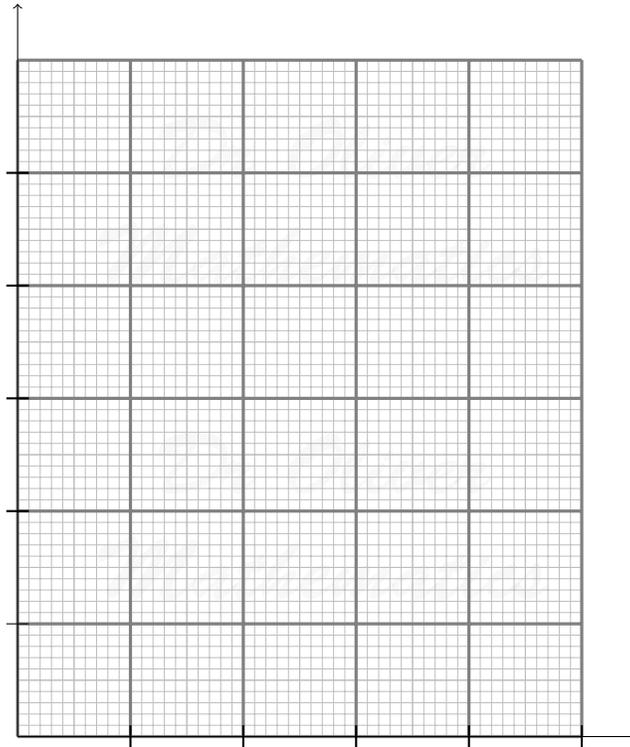
16. Solve (2)  
 $(x - 2)^2 = 3.$

Give your solutions correct to 3 significant figures.

17. The table gives information about the heights of 150 students.

Height, ( $h$ cm)	Frequency
$140 < h \leq 150$	15
$150 < h \leq 155$	30
$155 < h \leq 160$	51
$160 < h \leq 165$	36
$165 < h \leq 180$	18

(a) On the grid, draw a histogram for this information. (3)



(b) Work out an estimate for the fraction of the students who have a height between 150 cm and 170 cm. (2)

18. At time  $t = 0$  hours, a tank is full of water. (1)

Water leaks from the tank.

At the end of every hour, there is 2% less water in the tank than at the start of the hour.

The volume of water, in litres, in the tank at time  $t$  is  $V_t$ .

Given that

$$V_0 = 2000, \text{ and}$$
$$V_{t+1} = kV_t,$$

write down the value of  $k$ .

19. A triangle has vertices  $P$ ,  $Q$ , and  $R$ . (4)

The coordinates of  $P$  are  $(-3, -6)$ .

The coordinates of  $Q$  are  $(1, 4)$ .

The coordinates of  $R$  are  $(5, -2)$ .

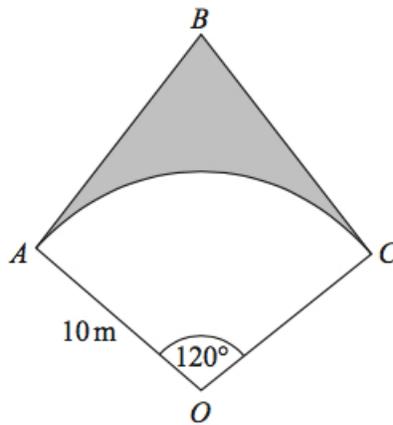
$M$  is the midpoint of  $PQ$ .

$N$  is the midpoint of  $QR$ .

Prove that  $MN$  is parallel to  $PR$ .

You must show each stage of your working.

20.  $OAC$  is a sector of a circle, centre  $O$ , radius 10 m. (5)



$BA$  is the tangent to the circle at point  $A$ .

$BC$  is the tangent to the circle at point  $C$ .

Angle  $AOC = 120^\circ$ .

Calculate the area of the shaded region.

Give your answer correct to 3 significant figures.

21. There are 12 counters in a bag.  
There is an equal number of red counters, blue counters, and yellow counters in the bag.  
There are no other counters in the bag.

3 counters are taken at random from the bag.

- (a) Work out the probability of taking 3 red counters. (2)

The 3 counters are put back in the bag.

Some counters are now put into the bag.

There is still an equal number of red counters, blue counters, and yellow counters in the bag.

There are no other counters in the bag.

3 counters are taken at random from the bag.

- (b) Is it now less likely or equally likely or more likely that 3 counters will be red? (2)  
You must show how you get your answer.

22. The functions  $f$  and  $g$  are such that (5)

$$f(x) = 5x + 3 \text{ and } g(x) = ax + b,$$

where  $a$  and  $b$  are constants.

$$g(3) = 20 \text{ and } f^{-1}(33) = g(1).$$

Find the value of  $a$  and the value of  $b$ .

23.  $S$  is a geometric sequence.

- (a) Given that (3)

$$(\sqrt{x} - 1), 1, \text{ and } (\sqrt{x} + 1)$$

are the first three terms of  $S$ , find the value of  $x$ .

You must show all of your working.

- (b) Show that the 5th term of  $S$  is (2)

$$7 + 5\sqrt{2}.$$