

Dr Oliver Mathematics
GCSE Mathematics
2018 November Paper 1H: Non-Calculator
1 hour 30 minutes

The total number of marks available is 80.

You must write down all the stages in your working.

1. Work out the value of (2)

$$\frac{3^7 \times 3^{-2}}{3^3}.$$

- 2.

$$v^2 = u^2 + 2as.$$

$$u = 12, a = -3, \text{ and } s = 18.$$

- (a) Work out a value of v . (2)

- (b) Make s the subject of (2)

$$v^2 = u^2 + 2as.$$

3. A bonus of £2100 is shared by 10 people who work for a company. (5)

40% of the bonus is shared equally between 3 managers.

The rest of the bonus is shared equally between 7 salesmen.

One of the salesmen says, "If the bonus is shared equally between all 10 people I will get 25% more money."

Is the salesman correct?

You must show how you get your answer.

4. It would take 120 minutes to fill a swimming pool using water from 5 taps.

- (a) How many minutes will it take to fill the pool if only 3 of the taps are used? (2)

- (b) State one assumption you made in working out your answer to part (a). (1)

5. A plane travels at a speed of 213 miles per hour.

- (a) Work out an estimate for the number of seconds the plane takes to travel 1 mile. (3)

- (b) Is your answer to part (a) an underestimate or an overestimate? (1)

Give a reason for your answer.

6. Solve the simultaneous equations

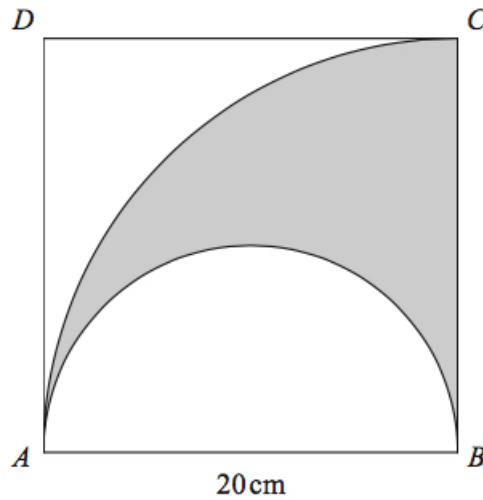
(3)

$$5x + y = 21$$

$$x - 3y = 9.$$

7. The diagram shows a square $ABCD$ with sides of length 20 cm. It also shows a semicircle and an arc of a circle.

(4)



AB is the diameter of the semicircle.
 AC is an arc of a circle with centre B .

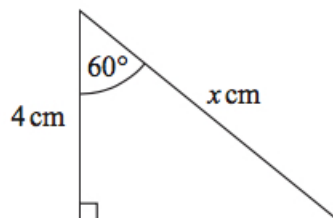
Show that

$$\frac{\text{area of shaded region}}{\text{area of square}} = \frac{1}{8}\pi.$$

8. (a) Write down the exact value of $\tan 45^\circ$.

(1)

Here is a right-angled triangle.



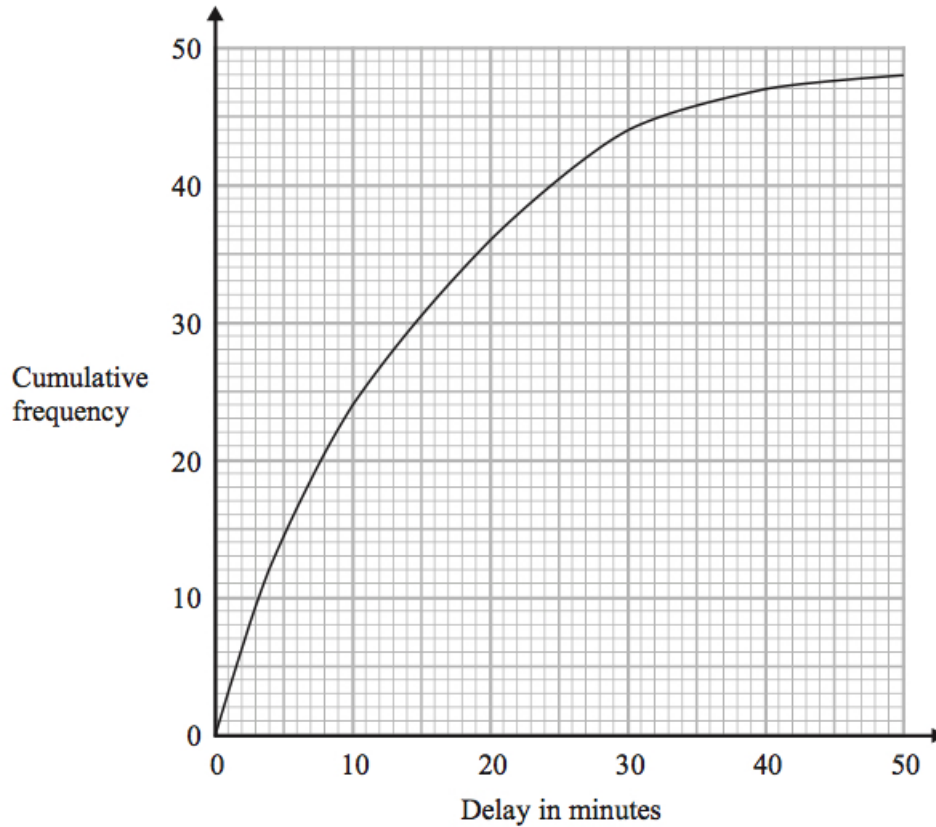
$$\cos 60^\circ = 0.5.$$

(b) Work out the value of x .

(2)

9. The times that 48 trains left a station on Monday were recorded.

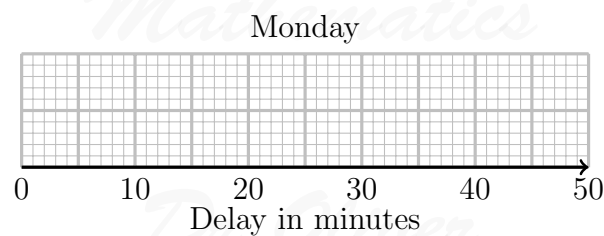
The cumulative frequency graph gives information about the numbers of minutes the trains were delayed, correct to the nearest minute.



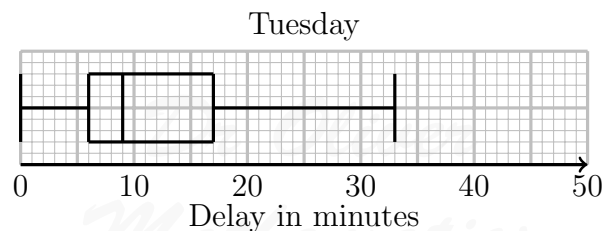
The shortest delay was 0 minutes.

The longest delay was 42 minutes.

(a) On the grid below, draw a box plot for the information about the delays on Monday. (3)



48 trains left the station on Tuesday.
The box plot below gives information about the delays on Tuesday.



- (b) Compare the distribution of the delays on Monday with the distribution of the delays on Tuesday. (2)

Mary says, “The longest delay on Tuesday was 33 minutes. This means that there must be some delays of between 25 minutes and 30 minutes.”

- (c) Is Mary right? (1)
You must give a reason for your answer.

10. (a) Simplify (1)

$$\frac{x - 1}{5(x - 1)^2}$$

- (b) Factorise fully (2)
- $$50 - 2y^2$$

11. Jack and Sadia work for a company that sells boxes of breakfast cereal. (3)

The company wants to have a special offer.

Here is Jack’s idea for the special offer.

Put 25% more cereal into each box and do **not** change the price.

Here is Sadia’s idea.

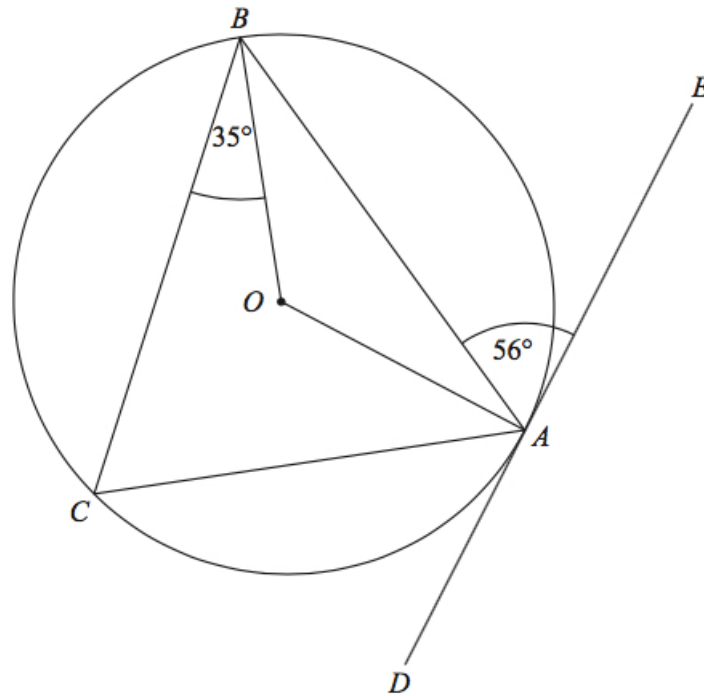
Reduce the price and do **not** change the amount of cereal in each box.

Sadia wants her idea to give the same value for money as Jack’s idea.

By what percentage does she need to reduce the price?

12. A , B , and C are points on the circumference of a circle, centre O .
 DAE is the tangent to the circle at A .

(3)

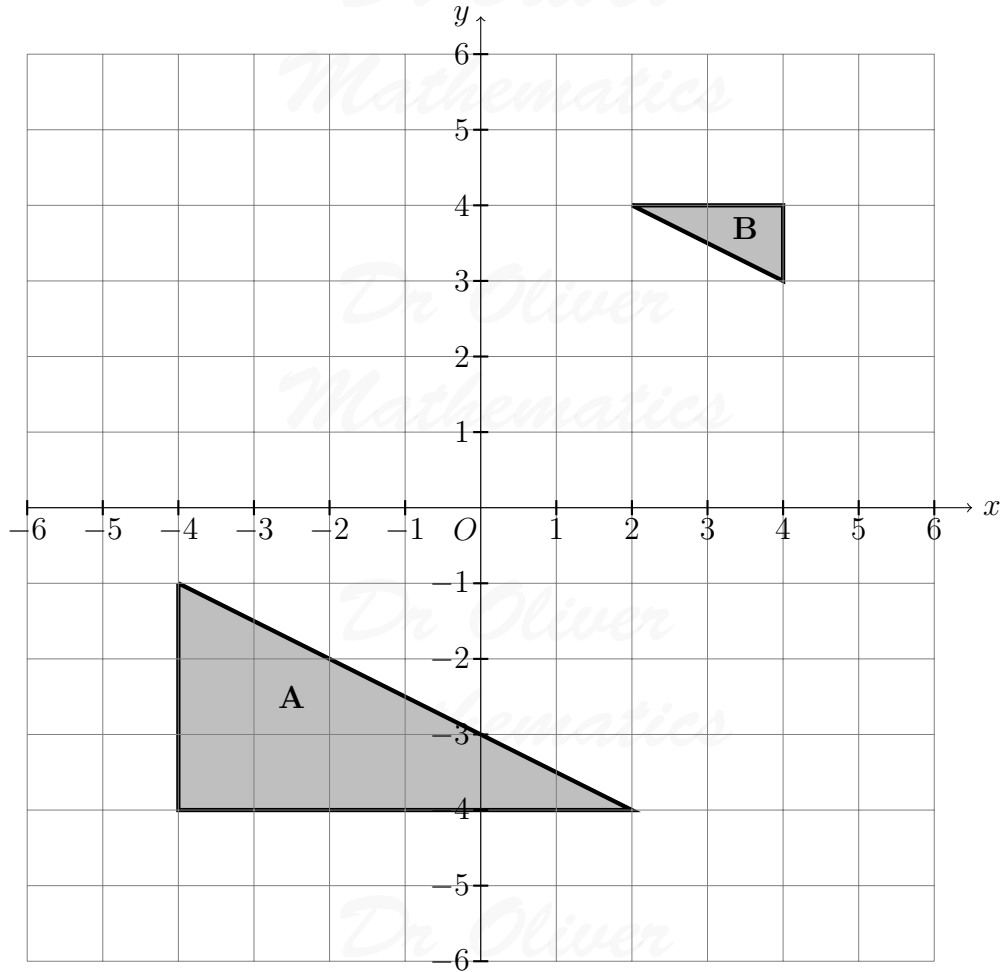


Angle $BAE = 56^\circ$.
Angle $CBO = 35^\circ$.

Work out the size of angle CAO .
You must show all your working.

13. Describe fully the single transformation that maps triangle **A** onto triangle **B**.

(2)



14. (a) Work out the value of

$$\left(\frac{16}{81}\right)^{\frac{3}{4}}.$$

(2)

$$3^a = \frac{1}{9} \quad 3^b = 9\sqrt{3} \quad 3^c = \frac{1}{\sqrt{3}}$$

(b) Work out the value of

$$a + b + c.$$

(2)

15. Three solid shapes **A**, **B**, and **C** are similar.

(4)

The surface area of shape **A** is 4 cm^2 .
 The surface area of shape **B** is 25 cm^2 .

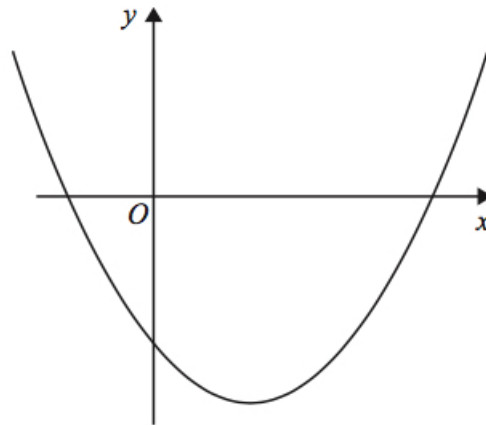
The ratio of the volume of shape **B** to the volume of shape **C** is 27 : 64.

Work out the ratio of the height of shape **A** to the height of shape **C**.
Give your answer in its simplest form.

16. Prove algebraically that (3)
 $0.2\dot{5}\dot{6}$

can be written as $\frac{127}{495}$.

17. Here is a sketch of a curve. (4)



The equation of the curve is

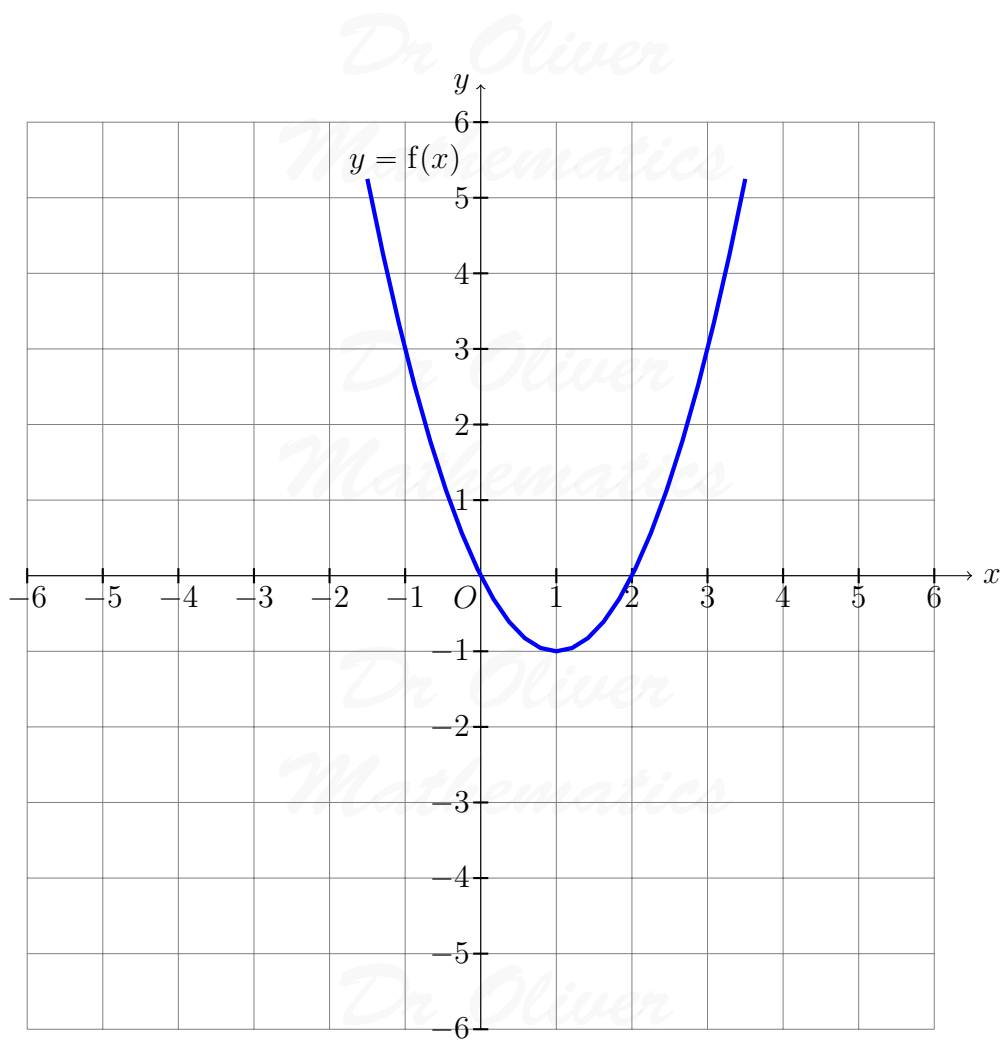
$$y = x^2 + ax + b,$$

where a and b are integers.

The points $(0, -5)$ and $(5, 0)$ lie on the curve.

Find the coordinates of the turning point of the curve.

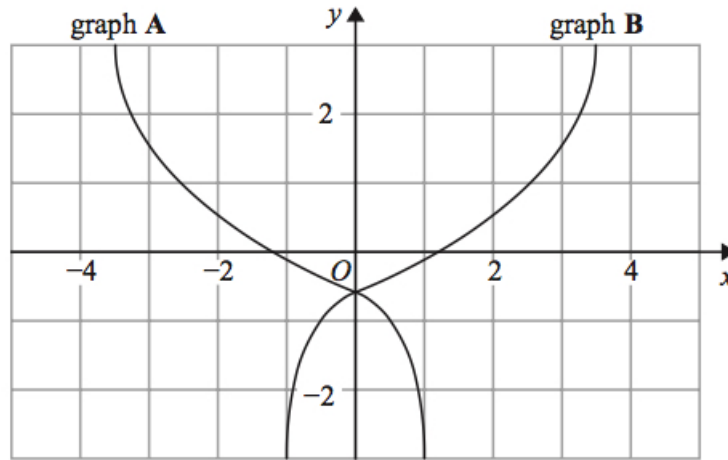
18. The graph of $y = f(x)$ is shown on the grid below.



(a) Sketch the graph of $y = f(x - 2)$.

(1)

On the grid, graph **A** has been reflected to give graph **B**.



The equation of graph **A** is $y = g(x)$.

(b) Write down the equation of graph **B**. (1)

19. For all values of x

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

(a) Show that (2)

$$gf(x) = 2x(x + 2).$$

(b) Find (2)

$$g^{-1}(7).$$

20. Show that (3)

$$\frac{(\sqrt{18} + \sqrt{2})^2}{\sqrt{8} - 2}$$

can be written in the form

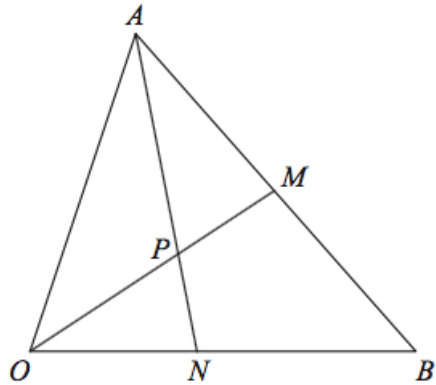
$$a(b + \sqrt{2}),$$

where a and b are integers.

21. OAB is a triangle. (5)

OPM and APN are straight lines.

M is the midpoint of AB .



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

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

$$OP : PM = 3 : 2.$$

Work out the ratio $ON : NB$.

22. There are only green pens and blue pens in a box. (6)

There are three more blue pens than green pens in the box.

There are more than 12 pens in the box.

Simon is going to take at random two pens from the box.

The probability that Simon will take two pens of the same colour is $\frac{27}{55}$.

Work out the number of green pens in the box.