Dr Oliver Mathematics
AQA GCSE Mathematics
2019 November Paper 2: Calculator
1 hour 30 minutes

The total number of marks available is 80.
You must write down all the stages in your working.

1. Expand (1)

$$4x^2(3x + 5).$$

Circle your answer.

$$32x^3 \quad 12x^3 + 20x^2 \quad 7x^3 + 9x^2 \quad 12x^2 + 5$$

2. How many millimetres are there in a kilometre? (1)
Circle your answer.

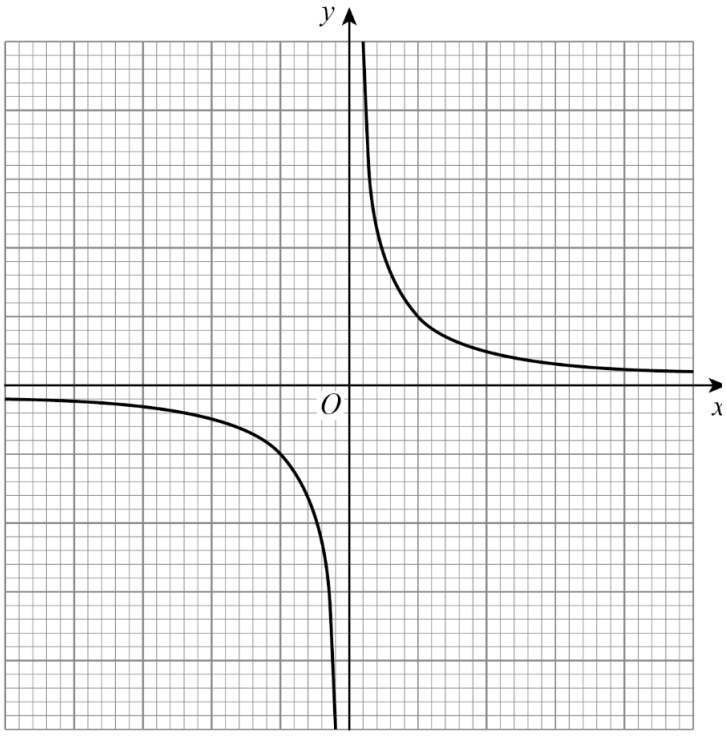
$$10^3 \quad 10^5 \quad 10^6 \quad 10^9$$

3. Circle the number half way between (1)

$$\frac{7}{12} \text{ and } \frac{3}{4}.$$

$$\frac{7}{32} \quad \frac{5}{8} \quad \frac{2}{3} \quad \frac{1}{2}$$

4. Here is the sketch of a graph. (1)

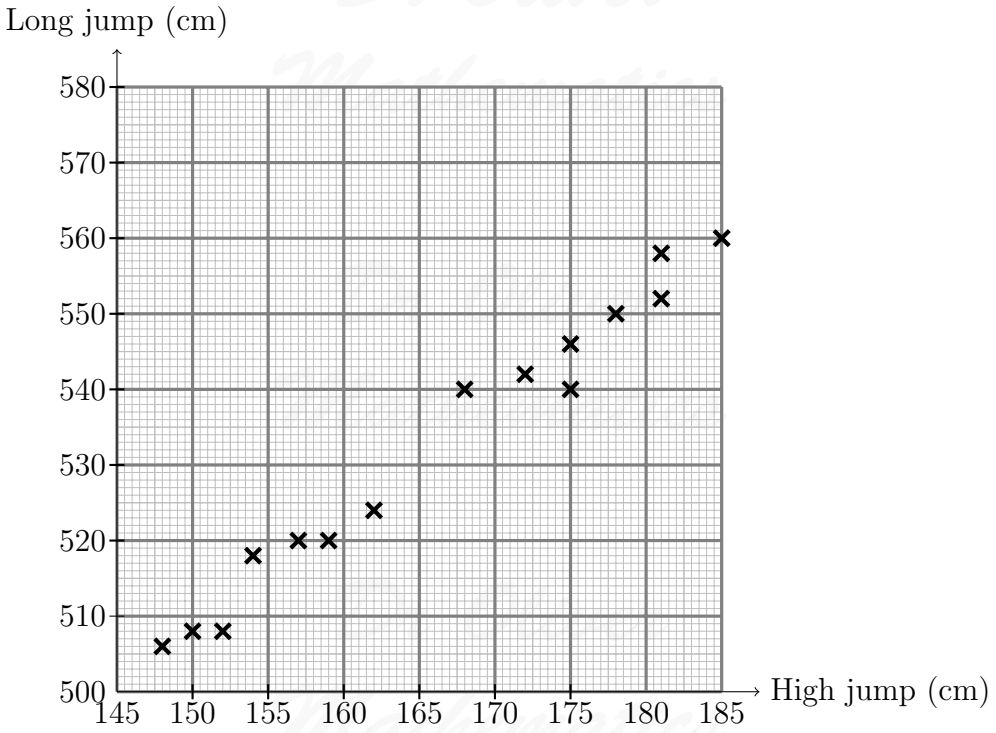


Circle the equation of the graph.

$$y = x \quad y = -x^2 \quad y = -x^3 \quad y = \frac{1}{x}$$

5. Work out the lowest common multiple (LCM) of 120 and 144 (2)

6. The scatter graph shows the best high jump and the best long jump for 15 boys.



(a) Write down the type of correlation shown. (1)

Liam has a best high jump of 166 cm.

(b) Use a line of best fit to estimate his best long jump. (2)

Another boy has a best high jump of 195 cm.

(c) Give a reason why you should **not** use a line of best fit to estimate his best long jump. (1)

7. A car journey is in two stages. (3)

- Stage 1: the car travels 110 miles in 2 hours.
- Stage 2: the car travels 44 miles at the same average speed as Stage 1.

Work out the time for Stage 2.
Give your answer in minutes.

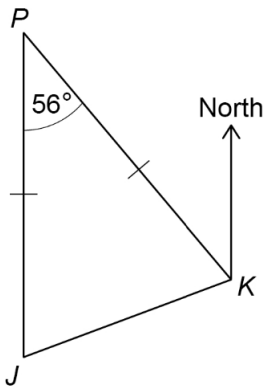
8. Here is an identity: (3)

$$a(3x - 10) \equiv 21x + 2b.$$

Work out the values of a and b.

9. J and K are ships. (3)
P is a port.

- J is due South of P.
- Angle $JPK = 56°$.
- $JP = KP$.



Not drawn accurately

Work out the bearing of J from K.

10. The 5th term of a linear sequence is 17. (3)
The 6th term of the sequence is 21.

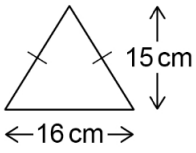
Work out the 100th term of the sequence.

11. The value of a house is £120 000. (4)

The value is expected to increase by 5% each year.

Work out the expected value after 4 years.
Give your answer to 2 significant figures.
You **must** show your working.

12. An isosceles triangle has base 16 cm and perpendicular height 15 cm. (4)



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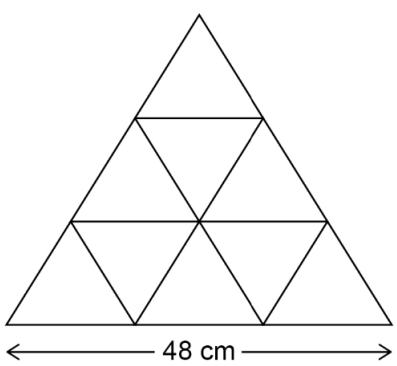
Some of these triangles are used to make a large triangle.



Work out the perimeter of the large triangle.

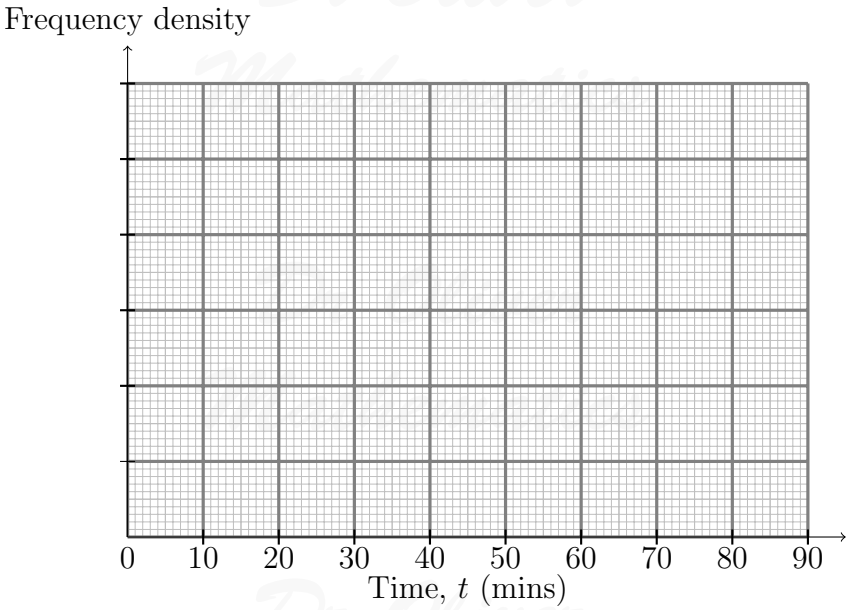
13. 200 people recorded the time they spent on social media one day.
The table shows the results.

Time, t (mins)	Frequency	Midpoint
$0 \leqslant t < 30$	24	
$30 \leqslant t < 50$	76	
$50 \leqslant t < 60$	52	
$6 \leqslant t < 90$	48	
	Total= 200	

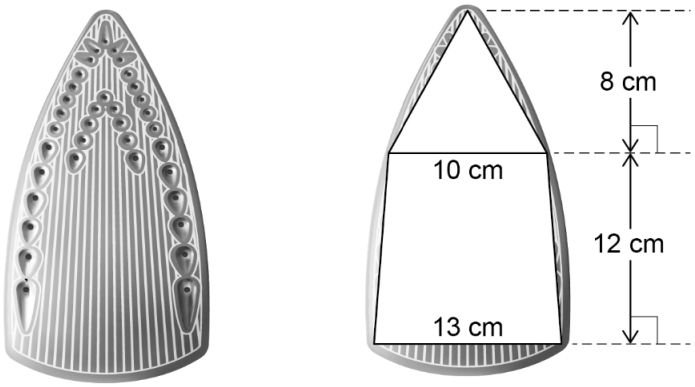
(a) Work out an estimate of the mean time. (3)

(b) Draw a histogram to represent the results. (4)

Time, t (mins)	Frequency	Class width
$0 \leqslant t < 30$	24	
$30 \leqslant t < 50$	76	
$50 \leqslant t < 60$	52	
$6 \leqslant t < 90$	48	



14. Ralf has an iron.
He models the base as a triangle joined to a trapezium.



(a) The iron applies a force of 25 newtons (N). (4)

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

Work out the pressure using Ralf's model.

(b) Is the actual pressure greater than, equal to, or less than your answer to part (a)? (2)
Tick **one** box.

☐ greater than ☐ equal to ☐ less than

Give a reason for your answer.

15. Rearrange (1)

$$y = \sqrt{w^3}$$

to make w the subject. Circle your answer.

$$w = y^6 \quad w = \sqrt[3]{y^2} \quad w = \sqrt{y^3} \quad w = y^5$$

16. (a) Show that (1)

$$a\% \text{ of } b = b\% \text{ of } a.$$

(b) Rosie says, "160% of 40 = 140% of 60 because $a\%$ of $b = b\%$ of a." (1)

Is she correct?
Tick a box.

☐ Yes ☐ No

Give a reason for your answer.

17. A packet contains 80 sweets.

The flavour of each sweet is lemon, orange, or apple.

A sweet is taken at random.

(a) P(lemon or orange) $\leqslant 0.85$. (2)

Work out the minimum possible number of **apple** sweets in the packet.

(b) P(lemon or apple) < 0.71. (2)
There are 31 lemon sweets.

Work out the maximum possible number of **apple** sweets in the packet.

18. Kate has the following question for homework.

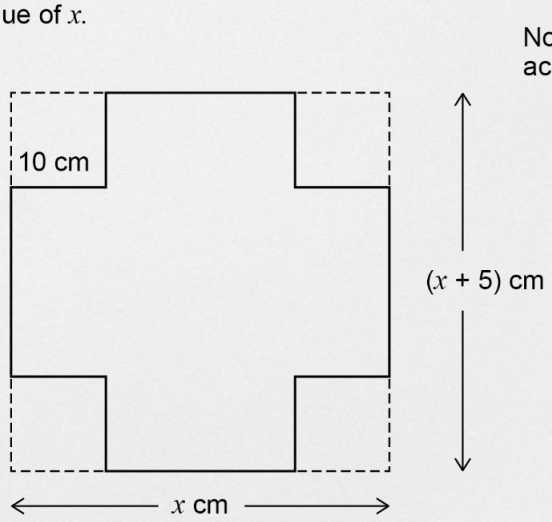
The net of a box is made by cutting four squares from a piece of cardboard

The cardboard is a rectangle with width x cm and length $(x + 5)$ cm

Each square has side length 10 cm

The area of the net is 1000 cm^2

Work out the value of x.



(a) Show that Kate can form the equation (3)

$$x^2 + 5x - 1\,400 = 0.$$

Kate correctly factorises the equation to get

$$(x + 40)(x - 35) = 0.$$

Her answer to the homework question is

$$x = -40 \text{ or } x = 35.$$

(b) Is her answer correct? (1)
Tick a box.

☐ Yes ☐ No

Give a reason for your answer.

19. Circle the word that describes the graph (1)

$$y = \sin x.$$

periodic exponential cubic quadratic

20. $(7, 28)$ is a point on the graph $y = \mathrm{f}(x)$. (1)
Circle the point which must be on the graph $y = \mathrm{f}(x) + 2$.

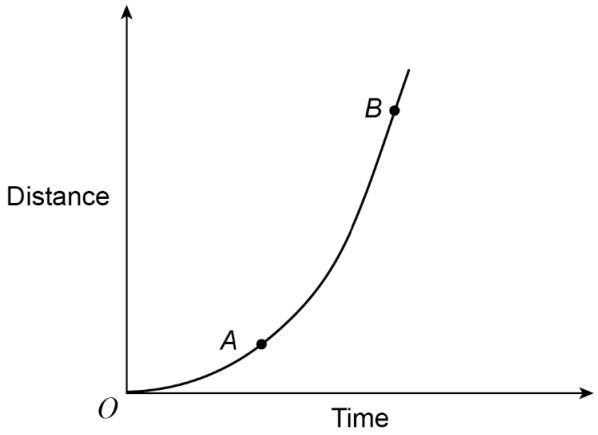
$(7, 26)$ $(7, 30)$ $(5, 28)$ $(9, 28)$

21. n is the middle integer of three consecutive positive integers. (4)

- The three integers are multiplied to give a product.
- n is then added to the product.

Prove that the result is a cube number.

22. Here is a sketch of a distance-time graph. (1)



Which of these represents the average speed between A and B?
Tick **one** box.

☐ The gradient of the tangent at *A*

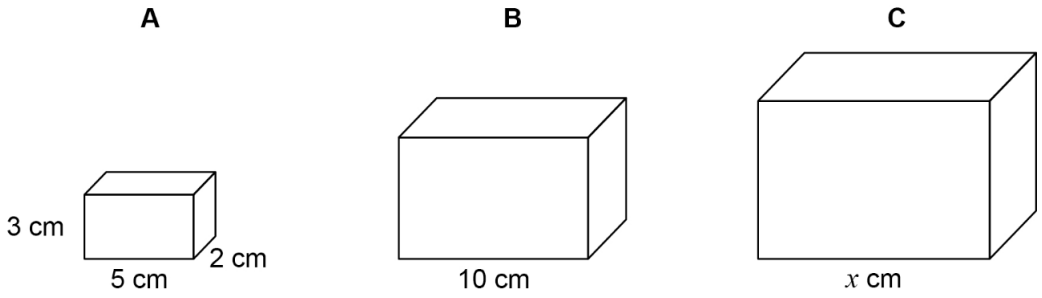
☐ The gradient of the tangent at *B*

☐ The gradient of the chord from *A* to *B*

☐ The gradient of the chord from *O* to *B*

23. Here are three similar cuboids: A, B, and C.

- A has length 5 cm, width 2 cm, and height 3 cm.
- B has length 10 cm.
- C has length x cm



(a) The total surface area of A is 62 cm^2. (1)
Tim wants to work out the total surface area of B.
Here is his working.

$10 \div 5 =$	2
$62 \times 2 =$	124
Total surface area of B =	124 cm^2

Make one criticism of Tim's method.

Volume of $A \times \dfrac{125}{8}$ = volume of C.

(b) Work out the value of x. (3)

24. Here are two inequalities. (3)

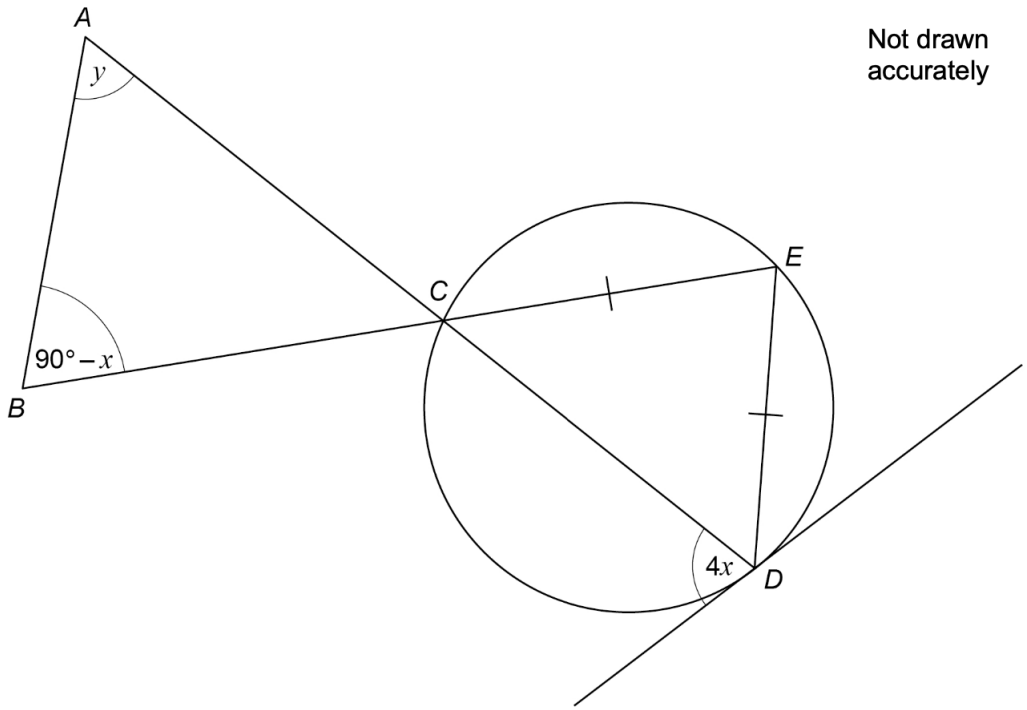
$$-2 \leqslant x \leqslant 3$$
$$9 \leqslant x + y \leqslant 11.$$

x and y are integers.

Work out the greatest possible value of

$$y - x.$$

25. C, D, and E are points on a circle. (4)
$CE = DE$.
The tangent at D is shown.
ACD and BCE are straight lines.



Prove that

$$y = 3x.$$

26. P, Q, and R have positive values. (5)

- P is directly proportional to the square of Q.
- When $P = 1.25$, $Q = 0.5$.
- Q is inversely proportional to R.
- When $Q = 0.5$, $R = 6$.

Work out the value of R when $P = 0.8$.

27. (3)

$$x_{n+1} = \sqrt[3]{3x_n + 7}.$$

Use a starting value of $x_1 = 2$ to work out a solution to

$$x = \sqrt[3]{3x + 7}.$$

Give your answer to 3 decimal places.