# Dr Oliver Mathematics
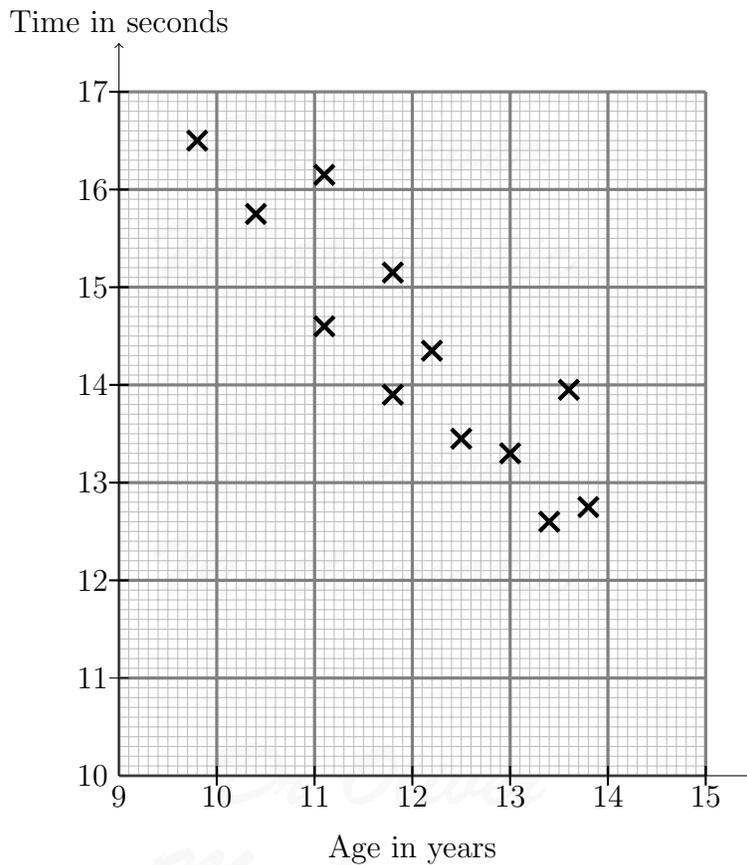# GCSE Mathematics
# 2018 Paper 3H: Calculator
# 1 hour 30 minutes

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

1. The scatter diagram shows information about 12 girls.
   It shows the age of each girl and the best time she takes to run 100 metres.



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

Kristina is 11 years old.
Her best time to run 100 metres is 12 seconds.
The point representing this information would be an outlier on the scatter diagram.

(b) Explain why. (1)
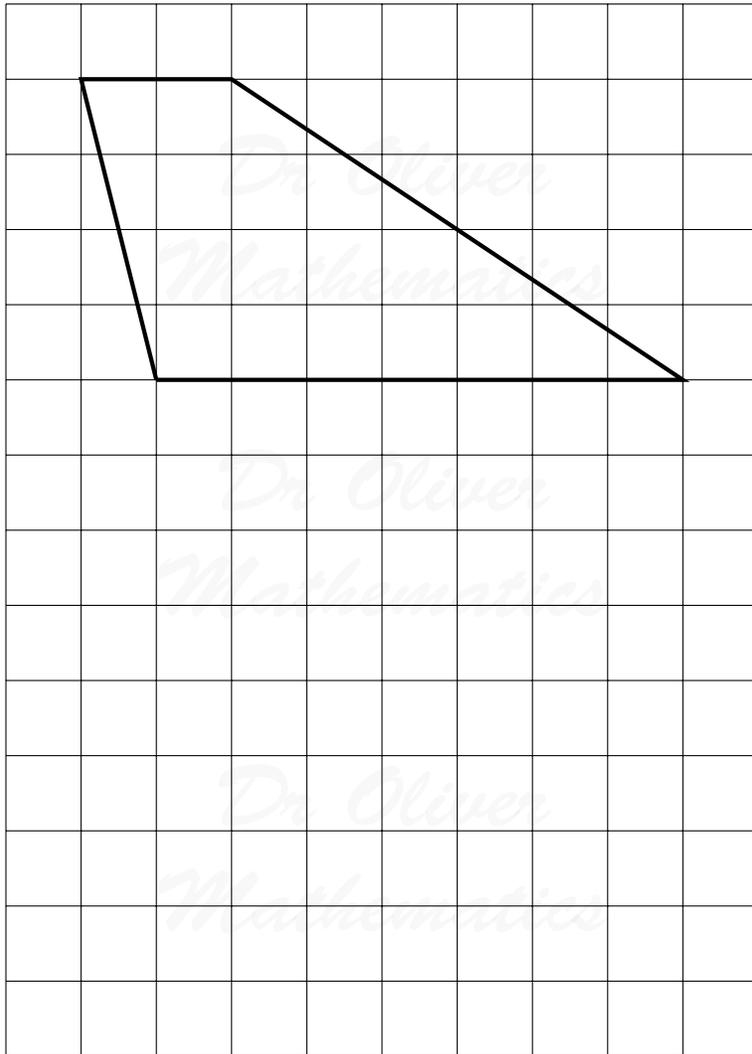
Debbie is 15 years old.

Debbie says, "The scatter diagram shows I should take less than 12 seconds to run 100 metres"

  (c)  Comment on what Debbie says.      (1)

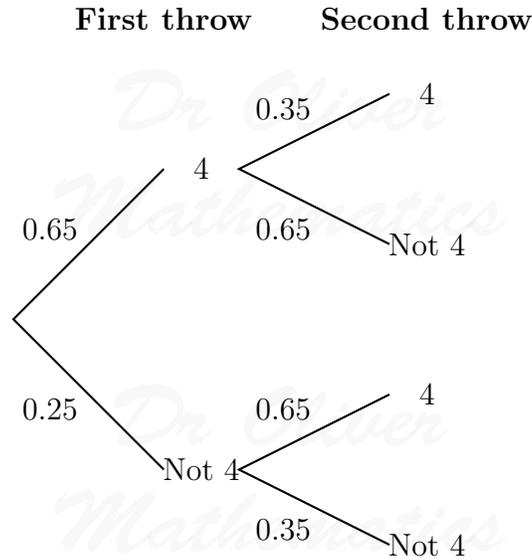2. Expand and simplify      (2)
$$5(p + 3) - 2(1 - 2p).$$

3. Here is a trapezium drawn on a centimetre grid.      (2)



On the grid, draw a triangle equal in area to this trapezium.

4. When a biased 6-sided dice is thrown once, the probability that it will land on 4 is 0.65. (2)
   The biased dice is thrown twice.
   Amir draws this probability tree diagram.
   The diagram is **not** correct.

   **First throw**    **Second throw**

   0.65 — 4
       0.35 — 4
       0.65 — Not 4

   0.25 — Not 4
       0.65 — 4
       0.35 — Not 4

   Write down **two** things that are wrong with the probability tree diagram.

5. $ABC$ is a right-angled triangle.

   A, 11 cm, C, 7 cm, B, right angle at C
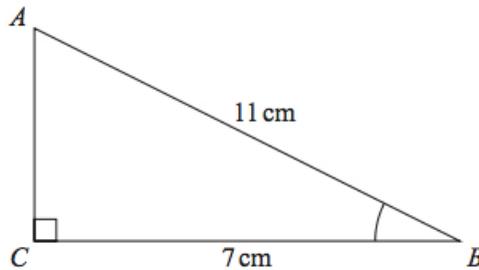
   (a) Work out the size of angle $ABC$. (2)
       Give your answer correct to 1 decimal place.

   The length of the side $AB$ is reduced by 1 cm.
   The length of the side $BC$ is still 7 cm.
   Angle $ACB$ is still 90°.

   (b) Will the value of $\cos ABC$ increase or decrease? (1)
       You must give a reason for your answer.

6. There are some counters in a bag.
   The counters are red or white or blue or yellow.
   Bob is going to take at random a counter from the bag.
   The table shows each of the probabilities that the counter will be blue or will be yellow.

   | Colour | Red | White | Blue | Yellow |
   |---|---|---|---|---|
   | Probability | | | 0.45 | 0.25 |

   There are 18 blue counters in the bag.
   The probability that the counter Bob takes will be red is twice the probability that the counter will be white.

   (a) Work out the number of red counters in the bag. (4)

   A marble is going to be taken at random from a box of marbles.
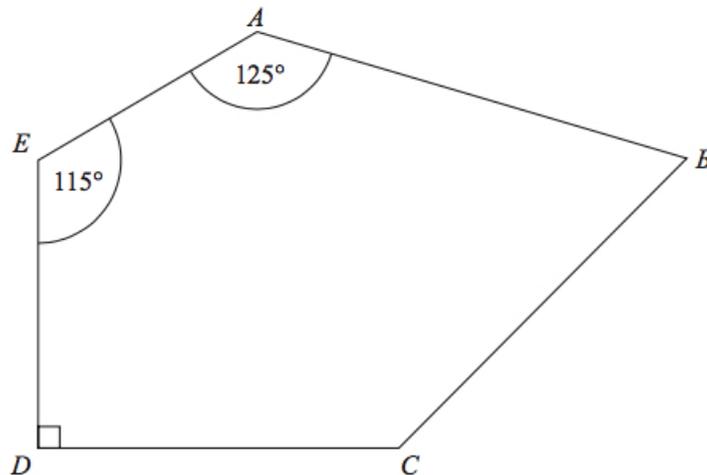   The probability that the marble will be silver is 0.5.

   There must be an even number of marbles in the box.

   (b) Explain why. (1)

7. Solve (3)
$$\frac{5-x}{2} = 2x - 7.$$

8. $ABCDE$ is a pentagon. (5)



Angle $BCD = 2 \times \angle ABC$.

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

9.

$$T = \sqrt{\frac{w}{d^3}}.$$
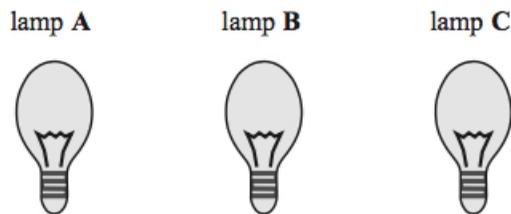
$w = 5.6 \times 10^{-5}$.
$d = 1.4 \times 10^{-4}$.

(a) Work out the value of $T$. (2)
Give your answer in standard form correct to 3 significant figures.

$w$ is increased by 10%.
$d$ is increased by 5%.
Lottie says, "The value of $T$ will increase because both $w$ and $d$ are increased."

(b) Lottie is wrong. (2)
Explain why.

10. Here are three lamps. (3)

lamp **A**    lamp **B**    lamp **C**

Lamp **A** flashes every 20 seconds.
Lamp **B** flashes every 45 seconds.
Lamp **C** flashes every 120 seconds.
The three lamps start flashing at the same time.
How many times in one hour will the three lamps flash at the same time?

11. In 2003, Jerry bought a house. (3)
In 2007, Jerry sold the house to Mia.
He made a profit of 20%.
In 2012, Mia sold the house for £162 000.
She made a loss of 10%.
Work out how much Jerry paid for the house in 2003.

12. The graph shows the volume of liquid ($L$ litres) in a container at time $t$ seconds.
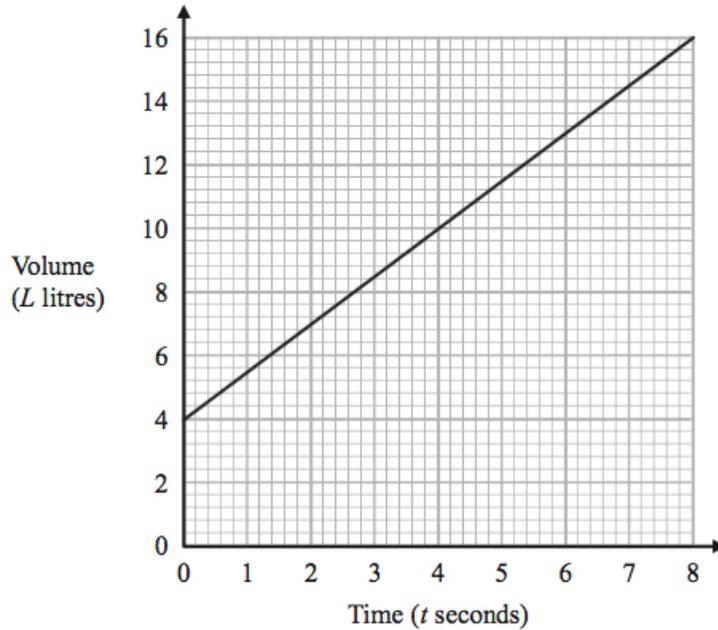
(a) Find the gradient of the graph. (2)

(b) Explain what this gradient represents. (1)

The graph intersects the volume axis at $L = 4$.

(c) Explain what this intercept represents. (1)

13. Here are two similar solid shapes. (3)



Surface area of shape **A** : surface area of shape B $= 3 : 4$.
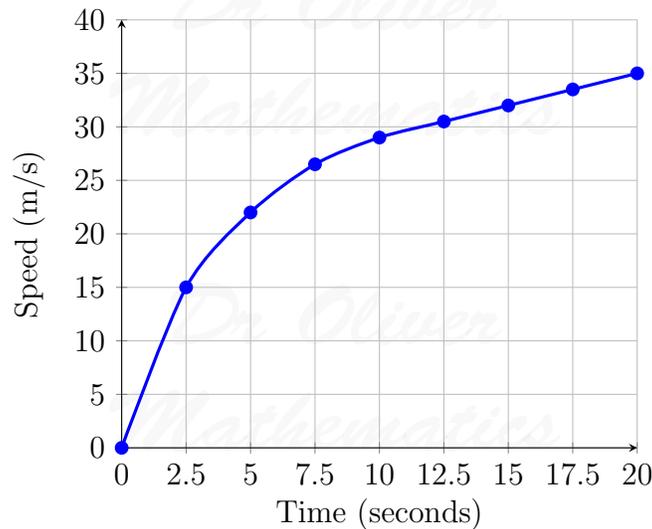The volume of shape B is $10 \text{ cm}^3$.

Work out the volume of shape **A**.
Give your answer correct to 3 significant figures.

14. There are 16 hockey teams in a league. (2)
    Each team played two matches against each of the other teams.

    Work out the total number of matches played.

15. The graph shows the speed of a car, in metres per second, during the first 20 seconds of
    a journey.



    (a) Work out an estimate for the distance the car travelled in the first 20 seconds. (3)
        Use 4 strips of equal width.

    (b) Is your answer to part (a) an underestimate or an overestimate of the actual distance (1)
        the car travelled in the first 20 seconds?
        Give a reason for your answer.

16. The $n$th term of a sequence is given by

$$an^2 + bn,$$

where $a$ and $b$ are integers.

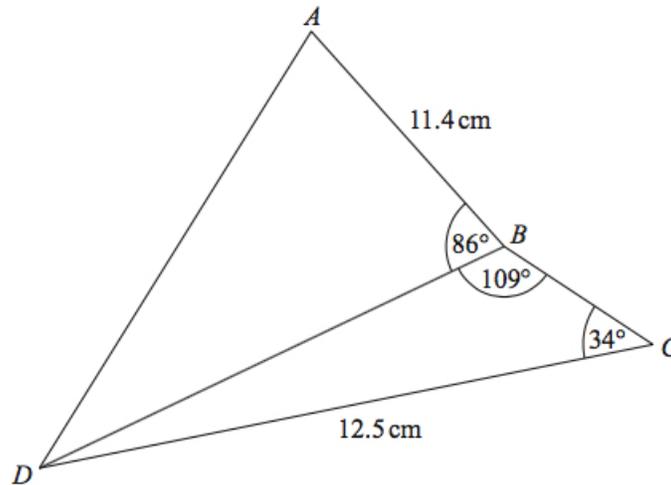The 2nd term of the sequence is $-2$.
The 4th term of the sequence is 12.

    (a) Find the 6th term of the sequence. (4)

Here are the first five terms of a different quadratic sequence:

$$0 \quad 2 \quad 6 \quad 12 \quad 20.$$

(b) Find an expression, in terms of $n$, for the $n$th term of this sequence. (2)

17. Work out the length of $AD$. (5)



Give your answer correct to 3 significant figures.

18. (a) Show that the equation (2)
$$x^3 + x = 7$$

has a solution between 1 and 2.

(b) Show that the equation (1)
$$x^3 + x = 7$$

can be rearranged to give
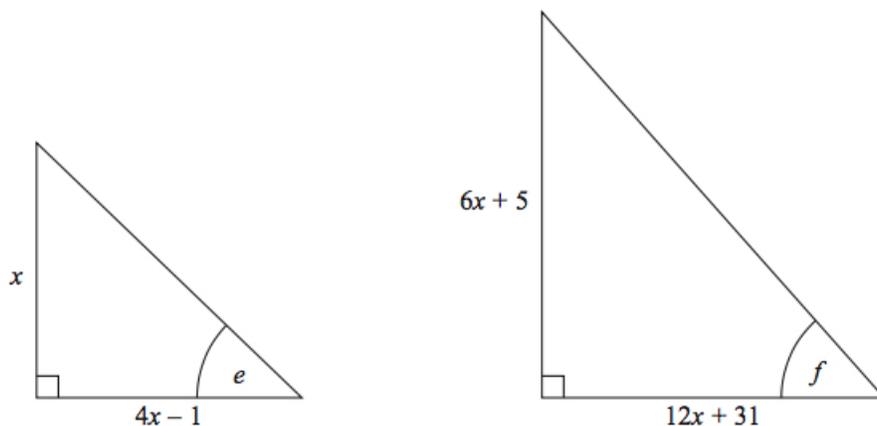$$x = \sqrt[3]{7 - x}.$$

(c) Starting with $x_0 = 2$, use the iteration formula (3)

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

three times to find an estimate for a solution of

$$x^3 + x = 7.$$

19. Here are two right-angled triangles. (5)

Given that
$$\tan e = \tan f,$$

find the value of $x$.
You must show all your working.

20. 50 people were asked if they speak French or German or Spanish. (5)

Of these people,
31 speak French;
2 speak French, German, and Spanish;
4 speak French and Spanish but not German;
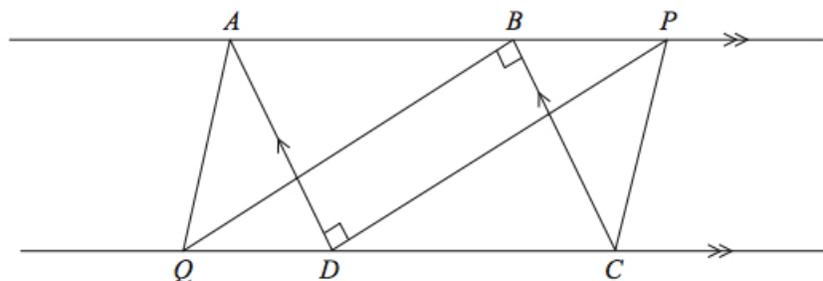7 speak German and Spanish;
8 do not speak any of the languages;
all 10 people who speak German speak at least one other language.

Two of the 50 people are chosen at random.

Work out the probability that they both only speak Spanish.

21. $ABCD$ is a parallelogram.

$ABP$ and $QDC$ are straight lines.

Angle $ADP$ = angle $CBQ = 90°$.

(a) Prove that triangle $ADP$ is congruent to triangle $CBQ$. (3)

(b) Explain why $AQ$ is parallel to $PC$. (2)