Mock Grade 8/9

Maths Booklet 4

Paper 3H
Calculator

1   Work out: $0.0\dot{7}$ $0.\dot{1}8\dot{5}$

(Total for Question 1 is 4 marks)
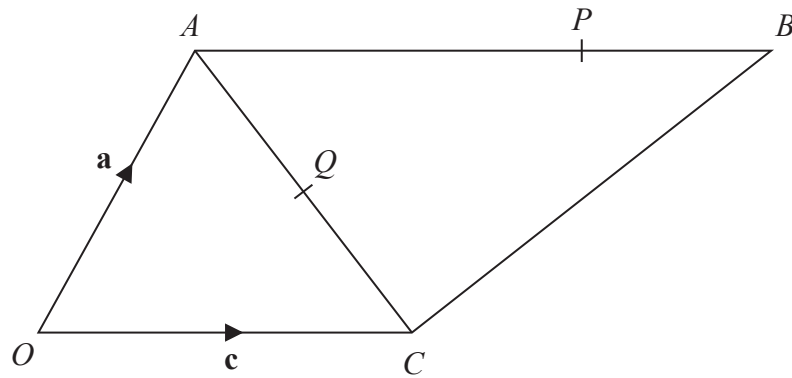
2

Diagram **NOT** accurately drawn

$\overrightarrow{OA} = \mathbf{a}$ $\overrightarrow{OC} = \mathbf{c}$ $\overrightarrow{AB} = 2\mathbf{c}$

P is the point on *AB* such that *AP* : *PB* = 3 : 1
Q is the point on *AC* such that *OQP* is a straight line.

Use a vector method to find *AQ* : *QC*
Show your working clearly.

AQ : *QC* = ...

(Total for Question 2 is 5 marks)

3 The diagram shows quadrilateral *ABCD*
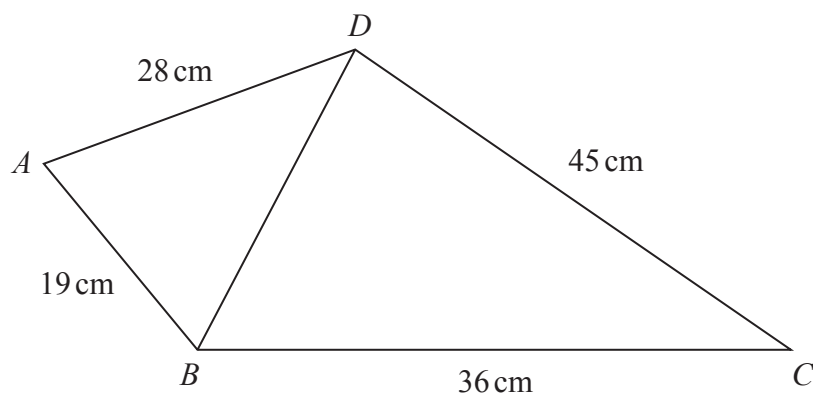

Diagram **NOT** accurately drawn

The angle *BCD* is acute.

Given that the area of triangle *BCD* = 405 cm²

work out the size of angle *ABD*
Give your answer correct to one decimal place.

°
....

(Total for Question 3 is 5 marks)

4 Elliot has x counters.

Each counter has one red face and one green face.

Elliot spreads all the counters out on a table and sees that the number of counters showing a red face is 5

Elliot then picks at random one of the counters and turns the counter over.
He then picks at random a second counter and turns the counter over.

The probability that there are still 5 counters showing a red face is $\dfrac{19}{32}$

Work out the value of x
Show clear algebraic working.

$x =$ ....

(Total for Question 4 is 5 marks)

5 (a) Write $7 + 12x - 3x^2$ in the form $a + b(x + c)^2$ where a, b and c are integers.

....

(4)

The curve **C** has equation $y = 7 + 12x - 3x^2$
The point A is the turning point on **C**.

(b) Using your answer to part (a), write down the coordinates of A.

(........................ , ...)

(1)

(Total for Question 5 is 5 marks)

6 y is inversely proportional to $\sqrt{x}$

   x is directly proportional to T^3

   Given that $y = 8$ when $T = 25$

   find the exact value of T when $y = 27$

$T = $ ....

(Total for Question 6 is 4 marks)

7 *ABCD* is a parallelogram and *ADM* is a straight line.
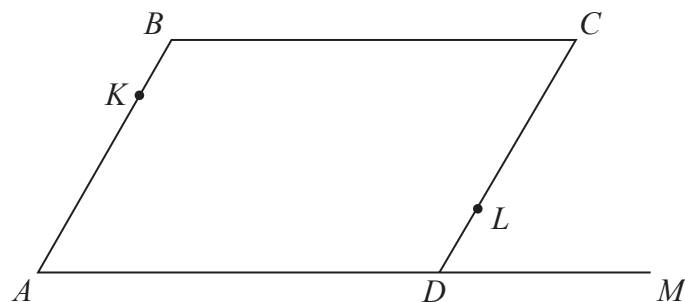
Diagram **NOT** accurately drawn

$$\overrightarrow{AB} = \mathbf{a} \qquad \overrightarrow{BC} = \mathbf{b} \qquad \overrightarrow{DM} = \frac{1}{2}\mathbf{b}$$

K is the point on *AB* such that $AK:AB = \lambda:1$
L is the point on *CD* such that $CL:CD = \mu:1$
KLM is a straight line.

Given that $\lambda:\mu = 1:2$

use a vector method to find the value of λ and the value of μ

$\lambda = $ ....

$\mu = $ ....

(Total for Question 7 is 5 marks)

8 At the start of year n, the number of animals in a population is P_n

At the start of the following year, the number of animals in the population is P_{n+1} where

$$P_{n+1} = kP_n$$

At the start of 2017 the number of animals in the population was 4000
At the start of 2020 the number of animals in the population was 2916
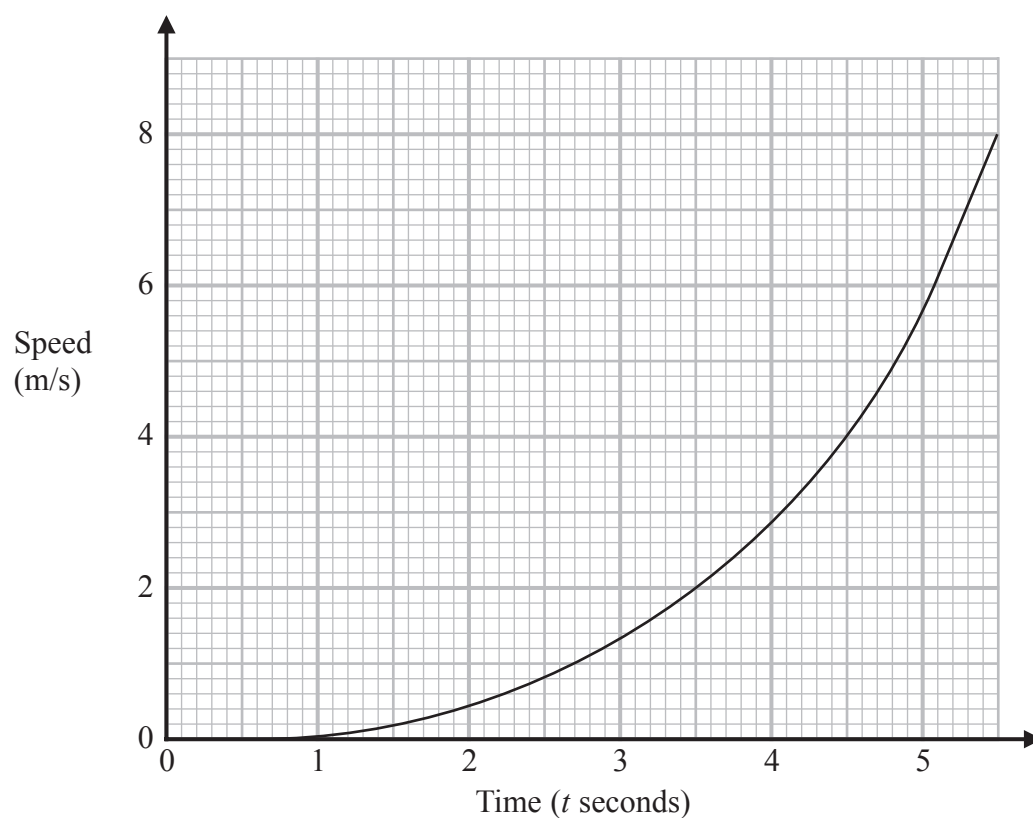
Find the value of the constant .

....

(Total for Question 8 is 3 marks)

9 Pat throws a fair coin n times.

Find an expression, in terms of n, for the probability that Pat gets at least 2 heads.

....

(Total for Question 9 is 3 marks)

10 Here is a speed-time graph showing the speed, in metres per second, of an object t seconds after it started to move from rest.

(a) Using 3 trapeziums of equal width, work out an estimate for the area under the graph between $t = 2$ and $t = 5$

....

(3)

(b) What does this area represent?

....
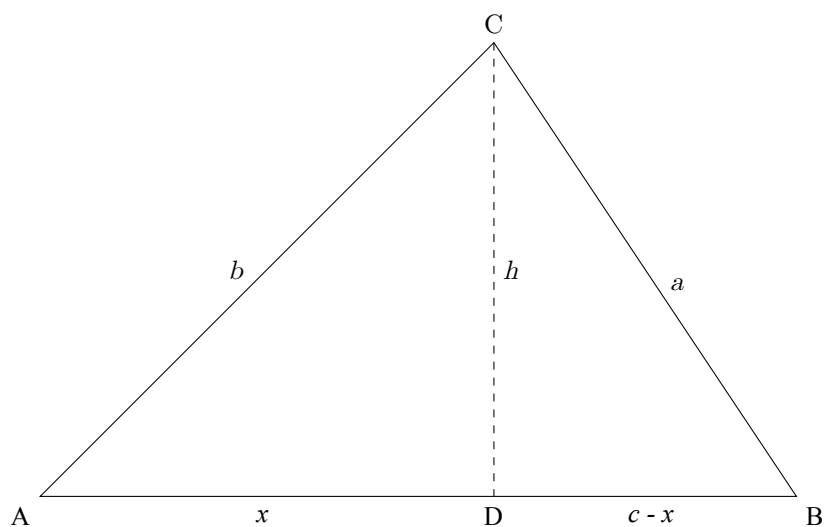
(1)

(Total for Question 10 is 4 marks)

11 Express $\left(\dfrac{20}{x^2 - 36} - \dfrac{2}{x - 6}\right) \times \dfrac{1}{4 - x}$ as a single fraction in its simplest form.

(Total for Question 11 is 3 marks)

12 *ABC* is a triangle.

Given angle *ADC* = 90°
AD = *x* cm
DB = (*c* - *x*) cm
AC = *b* cm
BC = *a* cm and
CD = *h* cm
Prove the cosine   ule

(Total for Question 12 is 5 marks)