

Dr Oliver Mathematics
Extended Mathematics Certificate
Sample Assessment Materials: Calculator
1 hour 15 minutes

The total number of marks available is 60.

You must write down all the stages in your working.

1. (a) Factorise (1)

$$x^2 - 25.$$

- (b) Write (3)

$$(x - 3)(x + 7)(x + 3)(x - 6)$$

in the form

$$(x^2 - d)(ax^2 + bx + c),$$

where a , b , c , and d are integers.

2. w , x , y , and z are four consecutive integers. (5)

Prove algebraically, that for any set of four consecutive integers

$$yz - wx$$

is equal to the sum of the four consecutive integers.

3. Triangles ABC and PQR are similar. (4)

Triangle ABC is an isosceles triangle where

- one of the angles is 40° ,
- one of the angles is obtuse, and
- two of the sides are each 10 cm.

Length $PQ = 1.5 \times$ length AB .

Work out the area of triangle PQR .

Give your answer correct to 3 significant figures.

4. The graph of

$$y = ab^{-x}$$

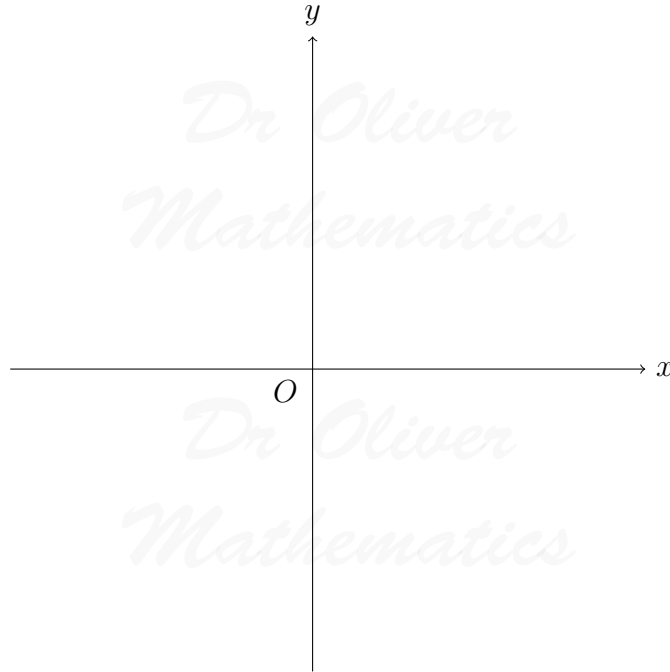
passes through the points $(0, 0.7)$ and $(3, 0.0875)$

- (a) Find the value of a and the value of b . (4)

(b) Hence, on the grid below, sketch the graph of

(2)

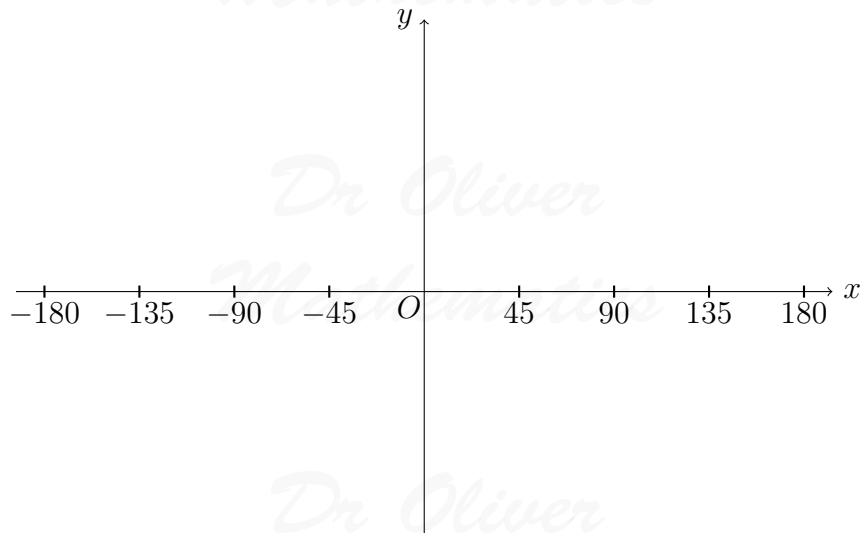
$$y = ab^{-x}.$$



5. (a) Sketch the graph of

(2)

$$y = \sin x^\circ \text{ for } -180 \leq x \leq 180.$$

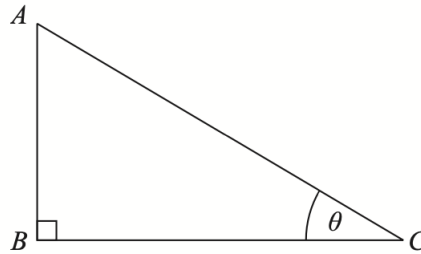


(b) Solve

$$2w^2 + 3w + 1 = 0.$$

(2)

ABC is a right-angled triangle.



(c) Use Pythagoras' theorem to show that

$$\sin^2 \theta^\circ + \cos^2 \theta^\circ = 1.$$

(3)

Given that

$$\sin^2 x^\circ + \cos^2 x^\circ = 1$$

is true for all values of x ,

(d) solve

$$3 - 2 \cos^2 x^\circ + 3 \sin x^\circ = 0 \text{ for } -180 \leq x \leq 180.$$

(4)

6. (a) Use the factor theorem to show that $(x - 2)$ is a factor of

$$x^3 - x^2 - 14x + 24.$$

(2)

Hence or otherwise, given that $x = 2y$,

(b) write the expression

$$8y^3 - 4y^2 - 28y + 24$$

(4)

as a product of its linear factors.

7. Use the trapezium rule to find an estimate for the area of the region under the curve

$$y = 2^x$$

(4)

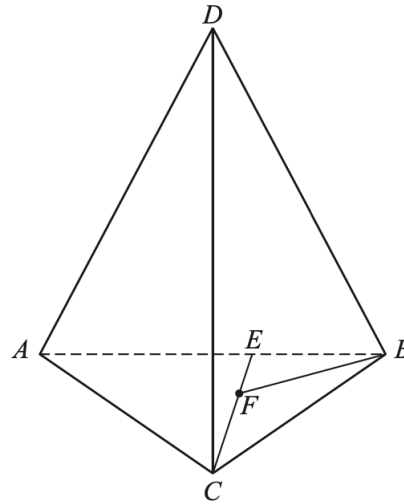
and between $x = 1$, $x = 7$, and the x -axis.

Use 4 strips of equal width.

Give your answer correct to 3 significant figures.

8. $ABCD$ is a triangular based pyramid.

(6)



- E is a point on the line AB .
- F is a point on the line CE , such that $CF : FE = 3 : 2$.
- $BC = 7.2$ cm.
- $BF = 4.1$ cm.
- Angle $CBF = 49^\circ$.
- Angle $CED = 109^\circ$.
- Angle $CDE = 32^\circ$.

Find the length of CD .

Give your answer correct to 3 significant figures.

9. Savio is buying base cupboards for a catering kitchen.

The cupboards come in two sizes, 600 mm wide and 900 mm wide.

Let x be the number of 600 mm cupboards and y be the number of 900 mm cupboards.

Two constraints are $x > 2$ and $0 < y \leq 9$.

(a) Explain in context what

$$0 < y \leq 9$$

(2)

represents.

A 600 mm cupboard costs £210.

A 900 mm cupboard costs £240.

Savio has a maximum budget of £3 600.

The total width of all the cupboards is 12 m or less.

(b) Use this information to show that

$$7x + 8y \leq 120$$

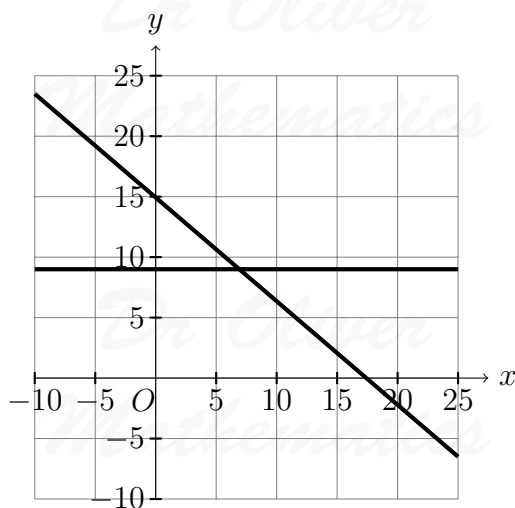
$$2x + 3y \leq 40.$$

(4)

(c) Draw a line on the grid and identify the feasible region.

Label the feasible region **R**.

(1)



Savio decides to buy 7 of the 600 mm cupboards and the maximum number of 900 mm cupboards possible.

(d) Work out the total amount of money Savio will spend buying these cupboards.

(2)

10. A bag contains only red counters and yellow counters.

(5)

There are more yellow counters than red counters.

A counter is taken at random from the bag, the colour noted, and then the counter is put back into the bag.

This process is repeated one more time.

The probability that exactly one of the two counters taken from the bag was red is 0.255.

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Simon then takes one counter from the bag.

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Find the probability that Simon takes a yellow counter from the bag.

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