A Level Further Maths

Transition Work

Summer 2023

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Current specification: OCR Further Mathematics B (MEI)

- Pure Core (50%)
- Statistics Minor (16⅔%)
- Mechanics Minor (16⅔%)
- Modelling with Algorithms (16⅔%)

Exam structure

- Pure Core - 2hrs 40mins
- Statistics Minor - 1hr 15mins
- Mechanics Minor - 1hr 15mins
- Modelling with Algorithms - 1hr 15mins

Sequences

Write the nth term rule for the following sequences:

a) 51, 54, 59, 66, 75, …

b) 3, 12, 27, 48, 75, …

c) 2.5, 4, 6.5, 10, 14.5, …

d) -6, -1, 6, 15, 26, …

e) 6, 13, 24, 39, 58, …

Simultaneous Equations

Solve the simultaneous equations:

$$a + b - c = 2$$
$$a - b + c = 0$$
$$-a + b + c = 8.$$

Now solve the simultaneous equations:

$$ka + b - c = 2$$
$$a - b + c = 0$$
$$-a + b + c = 8.$$

where k is a fixed but unknown number. Are there any values of k for which the equations have no solution?

Algebraic Fractions

Question 1: Fully simplify the following:

a

$$\frac{x^2 + 5x + 4}{x^2 + 4x + 3}$$

b

$$\frac{x^2 + 6x + 9}{x^2 - 2x - 15}$$

c

$$\frac{x^2 + 11x}{x^2 - 121}$$

d

$$\frac{x^2 - 1}{x^2 + x}$$

e

$$\frac{10x^2 - 23x + 12}{4x^2 + 4x - 15}$$

f

$$\frac{20x^2 + 21x + 4}{16x^2 - 1}$$

Question 2

(i) Solve the equation:

$$\frac{2}{x+3} + \frac{1}{x+1} = 1.$$

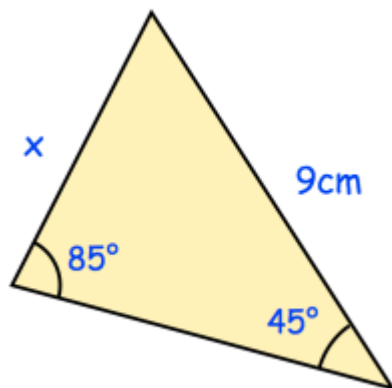(ii) Find the value(s) of b for which the following equation has a single (repeated) root.

$$9x^2 + bx + 4 = 0.$$

(iii) Find the range of (real) values of c for which the following equation has no real roots:
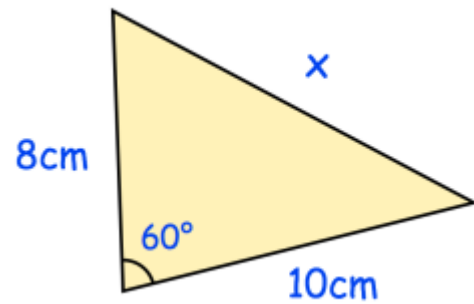
$$3x^2 + 5cx + c = 0.$$

Trigonometry

Calculate the missing side x.

a)
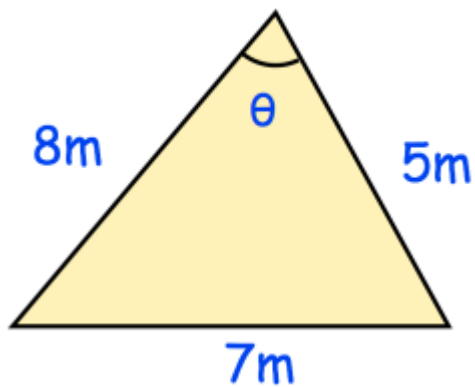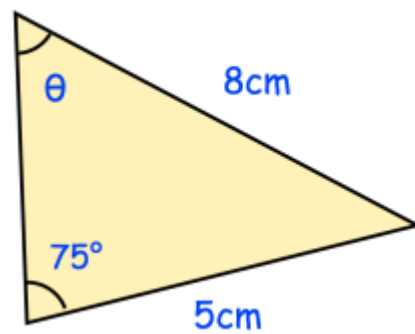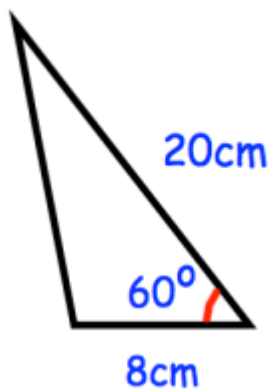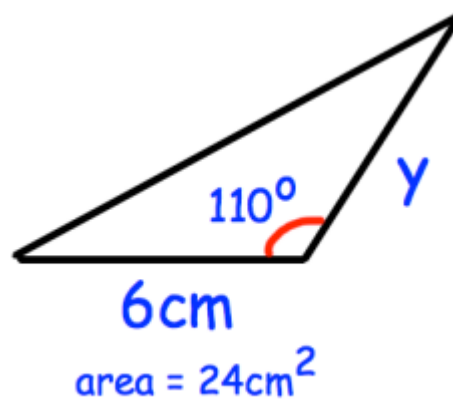

b)

Calculate the missing angle θ

c)

d)

e) Calculate the area of the triangle
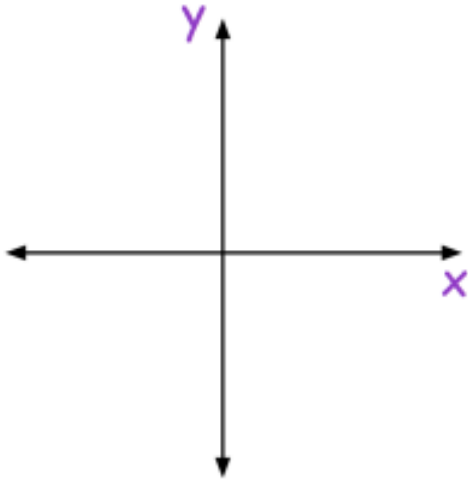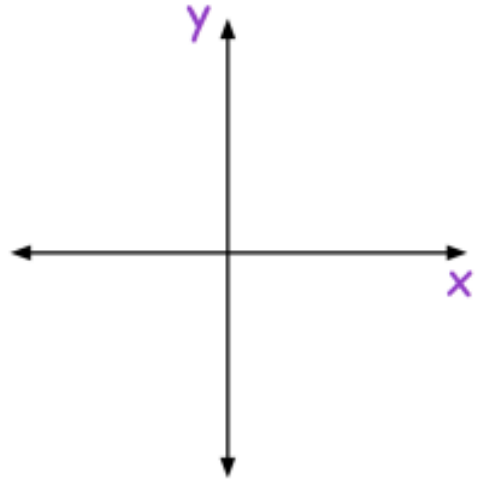

f) Calculate y

area = 24cm²

Graph Sketching

- Sketch the following graphs
- label any points of intersection with the axes
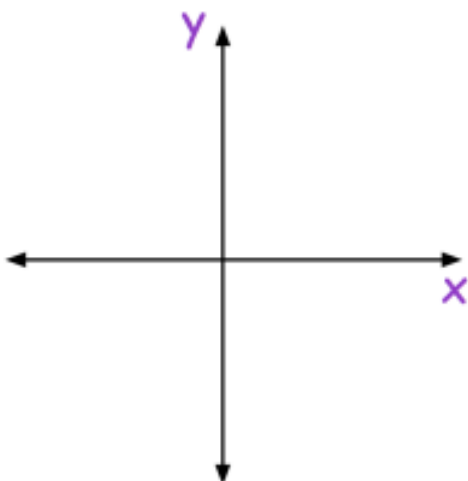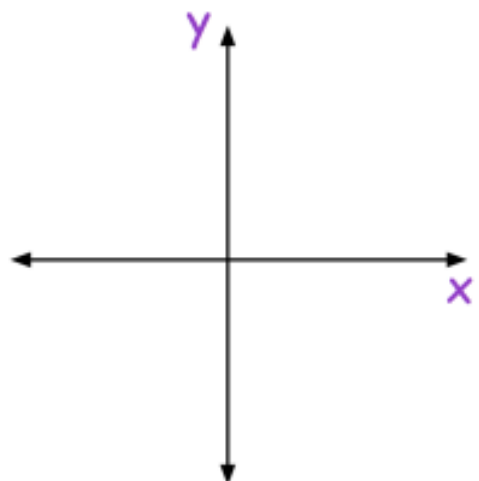- Label the turning point

a) $y = x^2 - 7x + 10$

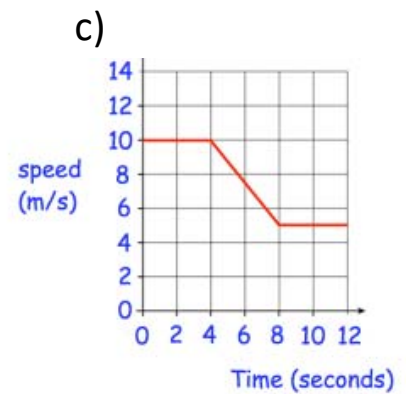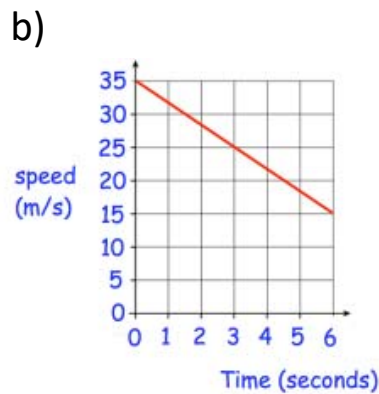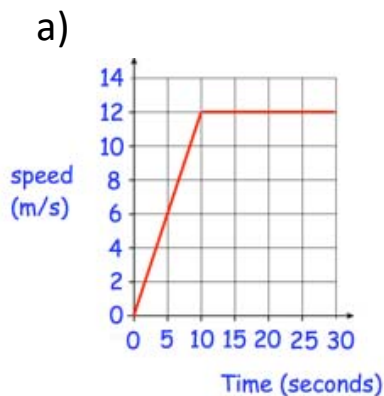b) $y = x^2 - 2x + 1$

c) $y = x^2 + 4x + 10$

d) $y = -x^2 - 5x - 4$

Section B: Mechanics

1. Shown below are speed-time graphs for some journeys. For each journey, calculate the total distance travelled.

a)

Time (seconds)

b)

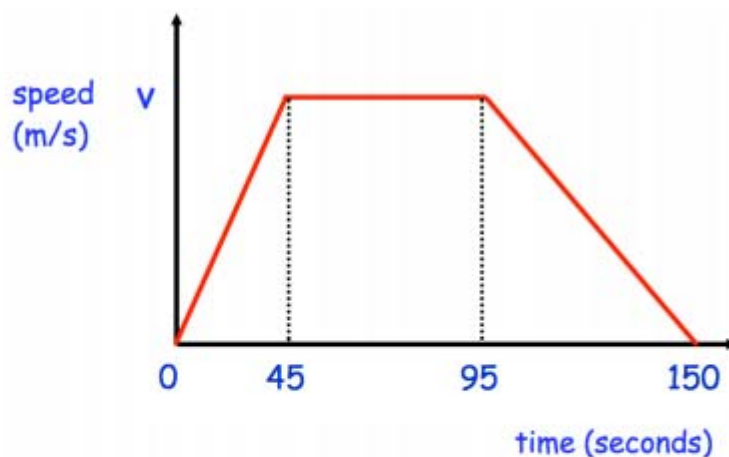Time (seconds)

c)

Time (seconds)

2. Here is a velocity time graph

(a) Work out an estimate for the distance travelled over 6 seconds. Use 3 strips of equal width.

(b) Is your answer to (a) an overestimate or an underestimate of the actual distance travelled?
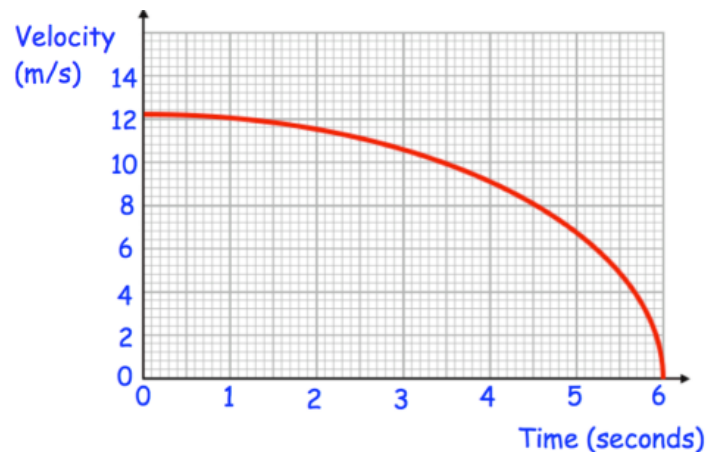
3. Here is a speed-time graph for a train journey

The journey took 150 seconds.
The train travelled 1.53km in the 150 seconds.

Work out the value of v.

Section C: Statistics

Calculate the following:

  a) Estimated mean
  b) Median class
  c) Modal class

Lifetime (months)	Frequency
$0 < t \le 12$	1
$12 < t \le 24$	9
$24 < t \le 36$	13
$36 < t \le 48$	56
$48 < t \le 60$	21

Time taken	Frequency
$0 < t \le 5$	5
$5 < t \le 10$	14
$10 < t \le 15$	10
$15 < t \le 20$	1

Answers

Sequences

a) $n^2 + 50$

b) $3n^2$

c) $0.5n^2 + 2$

d) $n^2 + 2n - 9$

e) $2n^2 + n + 3$

Simultaneous Equations

a) $a = 1$, $b = 5$, $c = 4$
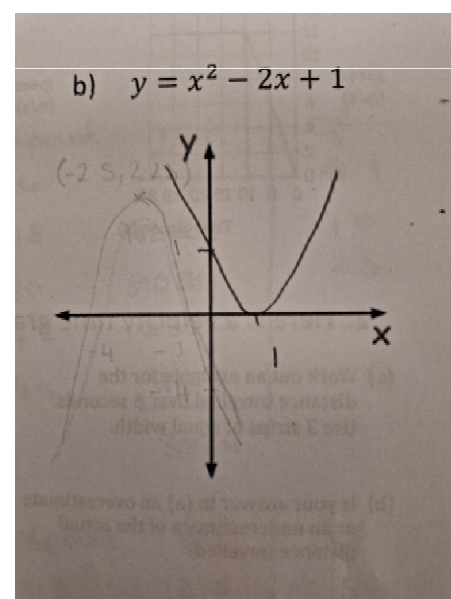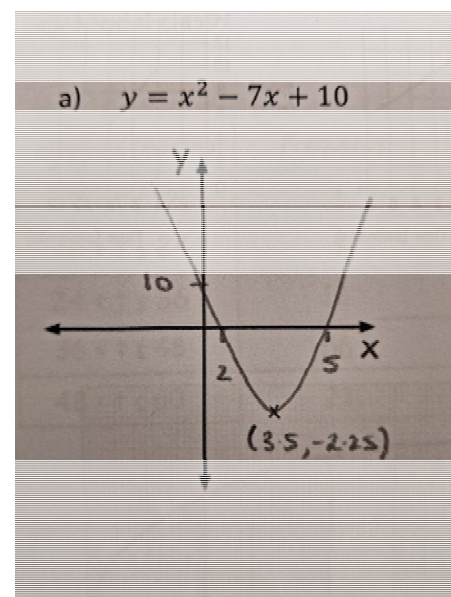
b) no solution if $k = -1$

Algebraic Fractions

a) $\dfrac{x+4}{x+3}$

b) $\dfrac{x+3}{x-5}$

c) $\dfrac{x}{x-11}$

d) $\dfrac{x-1}{x}$

e) $\dfrac{5x-4}{2x+5}$

f) $\dfrac{5x+4}{4x-1}$

a) $x = -2$ or $x = 1$

b) $b = 12$ or $b = -12$

c) $0 < c < \dfrac{12}{25}$
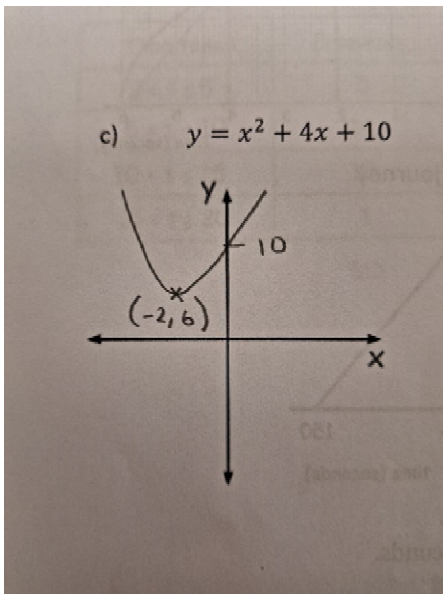
Trigonometry

a) $x = 6.39$ cm (3sf)

b) $x = 5.04$ cm (3sf)

c) $\Theta = 60°$

d) $\Theta = 37.1°$ (1dp)

e) Area $= 69.3$ cm^2 (3sf)

f) $y = 8.51$ cm (3sf)

Graph Sketching

a) $y = x^2 - 7x + 10$

$(3.5, -2.25)$

b) $y = x^2 - 2x + 1$

$(-2.5, 2.2)$

c) $y = x^2 + 4x + 10$

(-2, 6)

d) $y = -x^2 - 5x - 4$
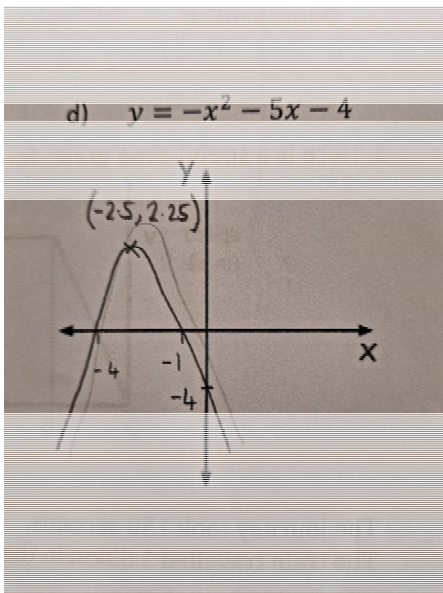

(-2.5, 2.25)

Statistics

1a) 38.34

1b) $36 < t \le 48$

1c) $36 < t \le 48$

2a) 8.67 (3sf)

2b) $5 < t \le 10$

2c) $5 < t \le 10$

Mechanics

1a) 300m

1b) 150m

1c) 90m

2a) 52m

2b) Underestimate

3) v = 15.3m/s