Write your name here

Surname	Other names

Pearson Edexcel
Level 3 GCE

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics

Year 11 to Year 12 Transition Paper

Quadratics

You must have:
Mathematical Formulae and Statistical Tables, calculator

Total Marks

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for algebraic manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer cross it out and put your new answer and any working out underneath.

Turn over ▶

Pearson

Calculators may NOT be used to answer these questions unless a symbol is shown next to the question.

1. (i) Show that $x^2 - 8x + 17 > 0$ for all real values of x

(3)

(ii) "If I add 3 to a number and square the sum, the result is greater than the square of the original number."

State, giving a reason, if the above statement is always true, sometimes true or never true.

(2)

(Total for question 1 is 5 marks)

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2. $f(x) = x^2 - 10x + 23$

(*a*) Express $f(x)$ in the form $(x + a)^2 + b$, where a and b are constants to be found.

(2)

(*b*) Hence, or otherwise, find the exact solutions to the equation

$$x^2 - 10x + 23 = 0$$

(2)

(Total for Question 2 is 4 marks)

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3. Factorise completely $x - 4x^3$.

(3)

(Total for Question 3 is 3 marks)

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4. The equation $kx^2 + 4kx + 3 = 0$, where k is a constant, has no real roots.

Prove that $0 \leq k < \frac{3}{4}$

(4)

(Total for question 4 is 4 marks)

5. The curve C has equation

$$y = \frac{k^2}{x} + 1 \qquad x \in \mathbb{R}, \quad x \neq 0$$

where k is a constant.

The line l has equation $y = -2x + 5$

(a) Show that the x coordinate of any point of intersection of l with C is given by a solution of the equation

$$2x^2 - 4x + k^2 = 0$$

(2)

(b) Hence find the exact values of k for which l is a tangent to C.

(3)

(Total for question 5 is 5 marks)

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6. Find, using algebra, all real solutions to the equation $b^4 + 7b^2 - 18 = 0$

(4)

(Total for question 6 is 4 marks)

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7. A company started mining tin in Riverdale on 1st January 2019.

A model to find the total mass of tin that will be mined by the company in Riverdale is given by the equation

$$T = 1200 - 3(n - 20)^2$$

where T tonnes is the total mass of tin mined in the n years after the start of mining.

Using this model,

(a) calculate the mass of tin that will be mined up to 1st January 2020,

(1)

(b) deduce the maximum total mass of tin that could be mined,

(1)

(c) calculate the mass of tin that will be mined in 2023.

(2)

(d) State, giving reasons, the limitation on the values of n.

(2)

(Total for question 7 is 6 marks)

8.

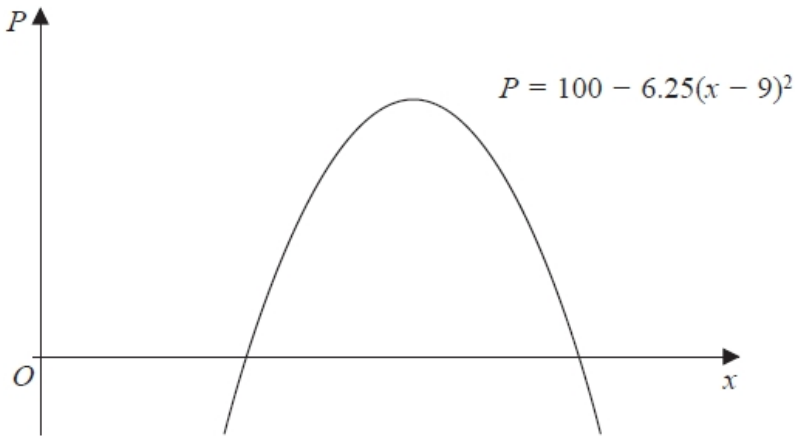

Figure 1

A company makes a particular type of children's toy.

The annual profit made by the company is modelled by the equation

$$P = 100 - 6.25(x - 9)^2$$

where P is the profit measured in thousands of pounds and x is the selling price of the toy in pounds.

A sketch of P against x is shown in Figure 1.

Using the model,

(*a*) explain why £15 is not a sensible selling price for the toy.

(2)

Give that the company made an annual profit of more than £80 000

(*b*) find, according to the model, the least possible selling price for the toy.

(3)

The company wishes to maximise its annual profit.

State, according to the model,

(*c*) (i) the maximum possible annual profit,

(ii) the selling price of the toy that maximises the annual profit.

(2)

(Total for question 8 is 7 marks)