Equation and Inequalities- Questions

May 2018 Mathematics Advanced Paper 1: Pure Mathematics 1

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)

2.

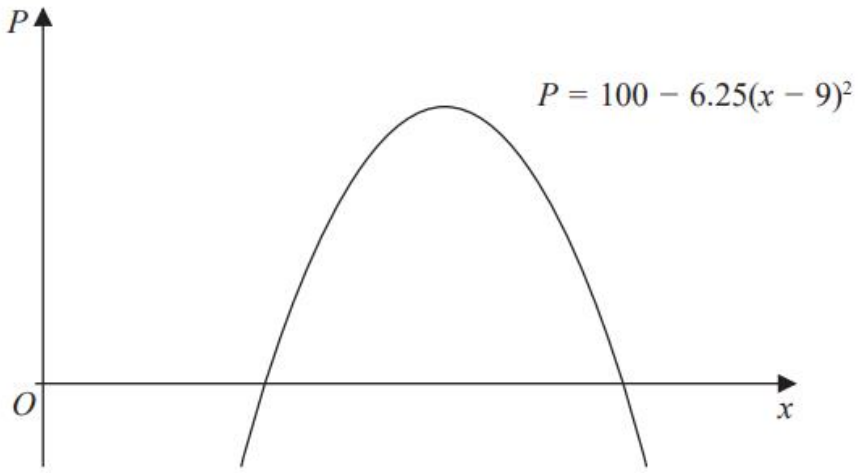

Figure 1

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)

Given 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)

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3.

Solve the simultaneous equations

$$y + 4x + 1 = 0$$

$$y^2 + 5x^2 + 2x = 0$$

(6)

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4.

Solve the simultaneous equations

$$y - 2x - 4 = 0$$

$$4x^2 + y^2 + 20x = 0$$

(7)

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5.

Find the set of values of x for which

(*a*) $3x - 7 > 3 - x$,

(2)

(*b*) $x^2 - 9x \leq 36$,

(4)

(*c*) **both** $3x - 7 > 3 - x$ **and** $x^2 - 9x \leq 36$.

(1)

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6.

Find the set of values of x for which

(*a*) $2(3x + 4) > 1 - x$,

(2)

(*b*) $3x^2 + 8x - 3 < 0$.

(4)

7.

Given the simultaneous equations

$$2x + y = 1$$
$$x^2 - 4ky + 5k = 0$$

where k is a non zero constant,

(*a*) show that $x^2 + 8kx + k = 0$.

(2)

Given that $x^2 + 8kx + k = 0$ has equal roots,

(*b*) find the value of k.

(3)

(*c*) For this value of k, find the solution of the simultaneous equations.

(3)

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8.

3. Find the set of values of x for which

(*a*) $4x - 5 \geqslant 15 - x$,

(2)

(*b*) $x(x - 4) > 12$.

(4)

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9.

4. Solve the simultaneous equations

$$x + y = 2$$
$$4y^2 - x^2 = 11$$

(7)

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10.

3. Find the set of values of x for which

(a) $3(x-2) < 8-2x$,

(2)

(b) $(2x-7)(1+x) < 0$,

(3)

(c) both $3(x-2) < 8-2x$ **and** $(2x-7)(1+x) < 0$.

(1)

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11.

5. Solve the simultaneous equations

$$y - 3x + 2 = 0$$

$$y^2 - x - 6x^2 = 0$$

(7)