

Topic X1: Indices, surds and quadratics (Pre-TT B) [42]

1.

Solve the equations

(i) $x^{\frac{1}{3}} = 2$, [1]

(ii) $10^t = 1$, [1]

(iii) $(y^{-2})^2 = \frac{1}{81}$. [2]

(Total 4 marks)

2.

(i) Calculate the discriminant of each of the following:

(a) $x^2 + 6x + 9$,

(b) $x^2 - 10x + 12$,

(c) $x^2 - 2x + 5$.

[3]

(ii)

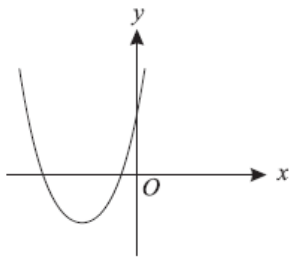


Fig. 1

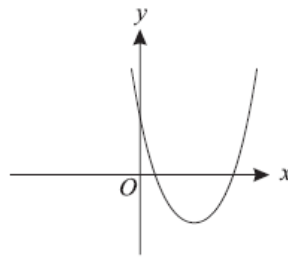


Fig. 2

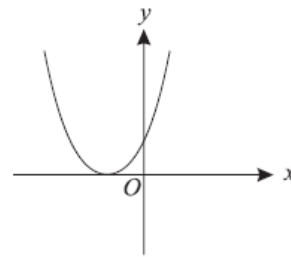


Fig. 3

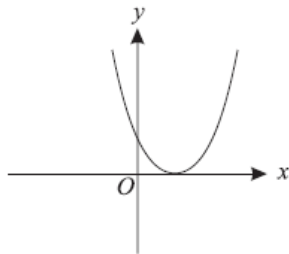


Fig. 4

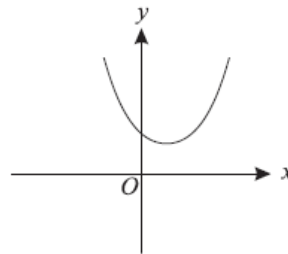


Fig. 5

State with reasons which of the diagrams corresponds to the curve

(a) $y = x^2 + 6x + 9$,

(b) $y = x^2 - 10x + 12$,

(c) $y = x^2 - 2x + 5$.

[4]

(Total 7 marks)

3.

Find the real roots of the equation $4x^4 + 3x^2 - 1 = 0$.

[5]

(Total 5 marks)

4.

(i) Express $2x^2 + 12x + 13$ in the form $a(x + b)^2 + c$.

[4]

(ii) Solve $2x^2 + 12x + 13 = 0$, giving your answers in simplified surd form.

[3]

(Total 7 marks)

5.

The line l has equation

$$3x - 2y = k$$

where k is a real constant.

Given that the line l intersects the curve with equation

$$y = 2x^2 - 5$$

at two distinct points, find the range of possible values for k .

(5)

(Total 5 marks)

6.

(i) Express $3x^2 + 12x + 7$ in the form $3(x + a)^2 + b$. [4]

(ii) Hence write down the equation of the line of symmetry of the curve $y = 3x^2 + 12x + 7$. [1]

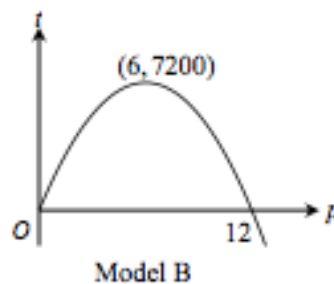
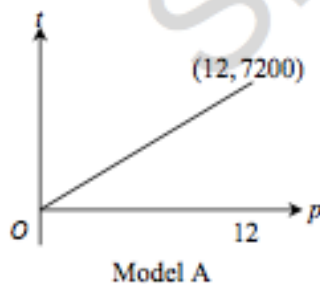
(Total 5 marks)

7.

A publisher has to choose the price at which to sell a certain new book. The total profit, $\pounds t$, that the publisher will make depends on the price, $\pounds p$. He decides to use a model that includes the following assumptions.

- If the price is low, many copies will be sold, but the profit on each copy sold will be small, and the total profit will be small.
- If the price is high, the profit on each copy sold will be high, but few copies will be sold, and the total profit will be small.

The diagram shows the graphs of two possible models.



(i) Explain how model A is inconsistent with one of the assumptions given above. [1]

(ii) Given that the equation of the curve in model B is quadratic, show that this equation is of the form $t = k(12p - p^2)$, and find the value of the constant k . [2]

(iii) The publisher needs to make a total profit of at least $\pounds 6400$. Use the equation found in part (ii) to find the range of values within which model B suggests that the price of the book must lie. [4]

(iv) Comment briefly on how realistic model B may be in the cases $p = 0$ and $p = 12.1$. [2]

(Total 9 marks)