

Cambridge International AS & A Level

Mathematics 9709

Paper 1 Pure Mathematics 1

Topic 1-Quadratics

Question No (14)

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Question No (14)

The equation of a curve is $y = x^2 - 6x + k$, where k is a constant.

(i) Find the set of values of k for which the whole of the curve lies above the x -axis.

(ii) Find the value of k for which the line $y + 2x = 7$ is a tangent to the curve.

Solution

Equation of curve

$$y = x^2 - 6x + k \rightarrow (1)$$

(i)

As curve lies above the x -axis,
mean does not cross x -axis

$$\Rightarrow b^2 - 4ac < 0$$

$$\Rightarrow (-6)^2 - 4(1)(k) < 0$$

$$36 - 4k < 0$$

$$-4k < -36$$

$$4k > 36$$

$$k > \frac{36}{4}$$

$$k > 9$$

$$\begin{aligned} & \therefore a > b \\ & -a < -b \end{aligned}$$

(ii)

Equation of line

$$y + 2x = 7$$

$$y = 7 - 2x \rightarrow (1)$$

Equation of curve

$$y = x^2 - 6x + k \rightarrow (2)$$

Solving (1) & (2)

$$7 - 2x = x^2 - 6x + k$$

$$x^2 - 6x + 2x + k - 7 = 0$$

$$x^2 - 4x + k - 7 = 0$$

As line is tangent to the curve

$$b^2 - 4ac = 0$$

$$(-4)^2 - 4(1)(k-7) = 0$$

$$16 - 4(k-7) = 0$$

$$16 - 4k + 28 = 0$$

$$-4k = -44$$

$$k = -\frac{44}{-4}$$

$$k = 11$$