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PURE MATH

ALGEBRA AND FUNCTION

Level & Board	EDEXCEL (A-LEVEL)
TOPIC:	QUADRATICS
PAPER TYPE:	SOLUTION 3
TOTAL QUESTIONS	8
TOTAL MARKS	40

Quadratics 3 (solution)

Q.1

Given

$2qx^2 + qx - 1 = 0$

For a quadratic equation,

$ax^2 + bx + c = 0$

The expression for solutions

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Where $b^2 - 4ac$ is called discriminant.

(a) Since, given is a quadratic equation with no real roots, its discriminant must be:

$b^2 - 4ac < 0$

$(q)^2 - 4(2q)(-1) < 0$

$q^2 + 8q < 0$ (Hence Proved)

(b)

$q^2 + 8q = 0$

$q(q + 8) = 0$

$q = 0$ or $q = -8$

So, the critical points on curve for given condition are -8 and 0.

Therefore, conditions for

$q^2 + 8q < 0$ are:

$q > -8$

$q < 0$

$\Rightarrow$ $-8 < q < 0$

Q.2

Quadratic equation $ax^2 + bx + c = 0$ has two distinct roots when discriminant is positive,

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

$kx^2 + k = 8x - 2x\,k$

$kx^2 + (2k - 8)x + k = 0$

Note that when $k = 0$, then we get linear equation with just one root.

In this equation,

$a = k,\ b = 2k - 8,\ c = k$

$\Rightarrow \quad (2k-8)^2 - 4(k)(k) > 0$

$4k^2 - 32k + 64 - 4k^2 > 0$

$\Rightarrow \quad -32k > -64$

$K < 2\ ,\ k \neq 0$

Q.3

Let $f(x) = x^3 + ax^2 + bx - 12$

$x - 2 = 0 \Rightarrow x - -2$

$x - 2$ is a factor of $f(x)$

So, reminder = 0

$\therefore (2)^3 + a(2)^2 + b(2) - 12 = 0$

$\Rightarrow \quad 8 + 4a + 2b - 12 = 0$

$\Rightarrow \quad 4a + 2b - 4 = 0$

$\Rightarrow \quad 2a + b - 2 = 0 \rightarrow (1)$

$x + 3 = 0 \Rightarrow x = -3$

$x + 3$ is a factor of $f(x)$

So, remainder = 0

$\therefore (-3)^3 + a(-3)^2 + b(-3) - 12 = 0$

$\Rightarrow \quad -27 + 9a - 3b - 12 = 0$

$\Rightarrow \quad -27 + 9a - 3b - 12 = 0$

$\Rightarrow \quad 9a - 3b - 39 = 0$

$\Rightarrow \quad 3a - b - 13 = 0 \rightarrow (1)$

Adding (a) and (2) , we get

$5a - 15 = 0$

$\Rightarrow \quad a = 3$

Putting the value of "a" in (1)

$6 + b - 2 = 0$

$\Rightarrow \quad b = -4$

Q.4

The quadratic equation is given

$x^2 - 4x - 1 = 2p(x-5)$

$x^2 - 4x - 1 = 2px - 10p$

$x^2 - 4x - 2px - 1 + 10p = 0$

$\Rightarrow \quad x^2 + (-4-2p)\,x + (10p-1) = 0$

Here,

$a = 1$, $b = -4-2p$, $c = 10p - 1$

Two equal root

$b^2 - 4ac = 0$

$(-4-2p)^2 - 4(1)(10p-1) = 0$

$16 + 16p + 4p^2 - 40p + 4 = 0$

$4p^2 - 24p + 20 = 0$

$\Rightarrow \quad p^2 - 6p + 5 = 0$

Factorization

$p^2 - 5p - p + 5 = 0$

$P(p-5) - 1(p-5) = 0$

$(p-1)(p-5) = 0$

$P - 1 = 0 \quad or \quad p - 5 = 0$

$P = 1 \quad or \quad p = 5$

So,

$P = 1, 5$

Q.5

$x^2 - 8x + 25$

$= (x-4)^2 - (-4)^2 + 25$

$= (x-4)^2 - 16 + 25$

$= (x-4)^2 + 9$

Q.6

$-2x^2 + 12x + 2$

$= -2(x^2-6x) + 2$

$= -2((x-3)^2 - 9) + 2$

$= -2(x-3)^2 + 18 + 2$

$= -2\ (x-3)^2 + 20$

Q.7

$4 - 3x - x^2$

$4 - (x^2 + 3x)$

Complete the square coefficient of the x term: 3 divide it in half: $\frac{3}{2}$

Square it: $\left(\frac{3}{2}\right)^2$

Use $\left(\frac{3}{2}\right)^2$ to complete the square:

$= 4 + \left(\frac{3}{2}\right)^2 - \left(x^2 + 3x + \left(\frac{3}{2}\right)^2\right)$

$= \frac{25}{4} - \left(x + \frac{3}{2}\right)^2$

Q.8

$8 + 2x - x^2$

$= 8 - (x^2 - 2x)$

$= 9 - (x^2 - 2x + 1)$

$= 9 - (x-1)^2$

$= 9 - (1)\ (x-1)^2$

$= a - b(x+c)^2$

Where $b = 1$, $c = -1$

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