

Exercise 6.2

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Question 1: If $f(x) = 2x^3 - 13x^2 + 17x + 12$, find

(i) $f(2)$

(ii) $f(-3)$

(iii) $f(0)$

Solution:

$$f(x) = 2x^3 - 13x^2 + 17x + 12$$

$$\begin{aligned} \text{(i) } f(2) &= 2(2)^3 - 13(2)^2 + 17(2) + 12 \\ &= 2 \times 8 - 13 \times 4 + 17 \times 2 + 12 \\ &= 16 - 52 + 34 + 12 \\ &= 62 - 52 \\ &= 10 \end{aligned}$$

$$\begin{aligned} \text{(ii) } f(-3) &= 2(-3)^3 - 13(-3)^2 + 17 \times (-3) + 12 \\ &= 2 \times (-27) - 13 \times 9 + 17 \times (-3) + 12 \\ &= -54 - 117 - 51 + 12 \\ &= -222 + 12 \\ &= -210 \end{aligned}$$

$$\begin{aligned} \text{(iii) } f(0) &= 2 \times (0)^3 - 13(0)^2 + 17 \times 0 + 12 \\ &= 0 - 0 + 0 + 12 \\ &= 12 \end{aligned}$$

Question 2: Verify whether the indicated numbers are zeros of the polynomials corresponding to them in the following cases:

(i) $f(x) = 3x + 1$, $x = -1/3$

(ii) $f(x) = x^2 - 1$, $x = 1, -1$

(iii) $g(x) = 3x^2 - 2$, $x = 2/\sqrt{3}, -2/\sqrt{3}$

(iv) $p(x) = x^3 - 6x^2 + 11x - 6$, $x = 1, 2, 3$

(v) $f(x) = 5x - \pi$, $x = 4/5$

(vi) $f(x) = x^2$, $x = 0$

(vii) $f(x) = lx + m$, $x = -m/l$

(viii) $f(x) = 2x + 1$, $x = 1/2$

Solution:

(i) $f(x) = 3x + 1$, $x = -1/3$

$$f(x) = 3x + 1$$

Substitute $x = -1/3$ in $f(x)$

$$f(-1/3) = 3(-1/3) + 1$$

$$= -1 + 1$$

$$= 0$$

Since, the result is 0, so $x = -1/3$ is the root of $3x + 1$

(ii) $f(x) = x^2 - 1$, $x = 1, -1$

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

Given that $x = (1, -1)$

Substitute $x = 1$ in $f(x)$

$$f(1) = 1^2 - 1$$

$$= 1 - 1$$

$$= 0$$

Now, substitute $x = (-1)$ in $f(x)$

$$f(-1) = (-1)^2 - 1$$

$$= 1 - 1$$

$$= 0$$

Since, the results when $x = 1$ and $x = -1$ are 0, so $(1, -1)$ are the roots of the polynomial $f(x) = x^2 - 1$

(iii) $g(x) = 3x^2 - 2$, $x = 2/\sqrt{3}, -2/\sqrt{3}$

$$g(x) = 3x^2 - 2$$

Substitute $x = 2/\sqrt{3}$ in $g(x)$

$$g(2/\sqrt{3}) = 3(2/\sqrt{3})^2 - 2$$

$$= 3(4/3) - 2$$

$$= 4 - 2$$

$$= 2 \neq 0$$

Now, Substitute $x = -2/\sqrt{3}$ in $g(x)$

$$g(2/\sqrt{3}) = 3(-2/\sqrt{3})^2 - 2$$

$$= 3(4/3) - 2$$

$$= 4 - 2$$

$$= 2 \neq 0$$

Since, the results when $x = 2/\sqrt{3}$ and $x = -2/\sqrt{3}$ are not 0. Therefore $(2/\sqrt{3}, -2/\sqrt{3})$ are not zeros of $3x^2 - 2$.

(iv) $p(x) = x^3 - 6x^2 + 11x - 6$, $x = 1, 2, 3$

$$p(1) = 1^3 - 6(1)^2 + 11 \times 1 - 6 = 1 - 6 + 11 - 6 = 0$$

$$p(2) = 2^3 - 6(2)^2 + 11 \times 2 - 6 = 8 - 24 + 22 - 6 = 0$$

$$p(3) = 3^3 - 6(3)^2 + 11 \times 3 - 6 = 27 - 54 + 33 - 6 = 0$$

Therefore, $x = 1, 2, 3$ are zeros of $p(x)$.

(v) $f(x) = 5x - \pi$, $x = 4/5$

$$f(4/5) = 5 \times 4/5 - \pi = 4 - \pi \neq 0$$

Therefore, $x = 4/5$ is not a zeros of $f(x)$.

(vi) $f(x) = x^2$, $x = 0$

$$f(0) = 0^2 = 0$$

Therefore, $x = 0$ is a zero of $f(x)$.

(vii) $f(x) = lx + m, x = -m/l$

$$f(-m/l) = l \times -m/l + m = -m + m = 0$$

Therefore, $x = -m/l$ is a zero of $f(x)$.

(viii) $f(x) = 2x + 1, x = \frac{1}{2}$

$$f(1/2) = 2 \times 1/2 + 1 = 1 + 1 = 2 \neq 0$$

Therefore, $x = \frac{1}{2}$ is not a zero of $f(x)$.

