بِسْمِ اللهِ الرَّحْمٰنِ الرَّحِيْمِ

বিস্‌মিল্লাহির রাহ্‌মানির রাহীম

6 | 13 | 2
12

1

উদ্ভাস

একাডেমিক এন্ড এডমিশন কেয়ার

POLL 1

IF (-11) is divided by 3, then what will be the quotient?

a)-3 ✗

b)3

c)-4

d)0

e)None of above

$-9 > -11$

$9 > -11$

POLL 2

IF (-11) is divided by 3, then what will be the remainder?

a)2

b)-2

c)-20

d)1

e)None of above

3) -11 (-4
-12
1

What is Remainder?

Suppose, the dividend is f(x), the divisor is (x-a)

And with them, the quotient is h(x) and the remainder is r

So, we can say,

f(x)=(x-a).h(x)+r

If we replace the value of x with a, we get,

f(a)=(a-a).h(a)+r,

Or, f(a)=r

Which was our remainder.

$x-2=0 \therefore x=2$

$f(x) \rightarrow (x-a) \longrightarrow f(a)$

$(x-3) \longrightarrow f(3)$

$x+2=0 \therefore x=-2 \quad f(-2)$

$f(x) = (x-a)\, h(x) + r$

x^2-3x-2

$3^2-3\cdot 3-2$

$=9-9-2$

$=-2$

$h(x)$

$f(x)$

$x-2 \,)\, x^2-8x+6 \,(\, x-6$

x^2-2x

$-6x+6$

$-6x+12$

$-6 \rightarrow r$

$f(2)=r$

$f(x)=x^2-8x+6$

$f(2)=(2)^2-8\cdot 2+6=4-16+6=-6$

Poll Question: 03

01. $f(x) = x^3 - x - 6$

If we divide f(x) by (x-3) ,what will be the remainder?

(a) 16 (b) 17 (c) 18 (d) 19

$x = 3$

$f(3) = 3^3 - 3 - 6$

$= 27 - 3 - 6$

$= 18$

$$\begin{array}{r} 36 \\ -9 \\ \hline 25 \end{array}$$

27

The Remainder Theorem

- **If you divide a polynomial f(x) by (x – a), then the remainder is f(a).**
- **If you divide a polynomial f(x) by (x + a), then the remainder is f(-a).**
- **If the degree of f(x) is positive, and a≠0, then if you divide f(x) by (ax+b), the remainder will be f(-b/a)**

$2x+3=0$

$2x=-3$

$\therefore x=-\frac{3}{2}$

$f(x) \quad (x-2) \quad f(2)$

$f(x) \quad (2x+3) \quad f(-\frac{3}{2})$

$6)73(12$ $\quad 72$ $\quad 1$

$6)72(12$ $\quad 72$ $\quad 0$

Factor Theorem:

$f(x) \rightarrow (x-a) \rightarrow f(a)$

If and only if the value of f(a) is 0, then the polynomial f(x) is divisible by (x–a).

Then (x-a) is a factor of f(x).

$f(x)$ $\quad (x+3)$

$f(-3)=0$

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

$f(-2)=(-2)^2-(-2)-6$

$=4+2-6=0$

$(x+2) \rightarrow$ factor of $f(x)$

Poll Question: 4

If $f(x) = 3x^2 - 7x - 6$,then which one will be a factor of f(x)?

(a) $(x + 1)$ (b) $(x - 1)$ (c) $(x - 2)$ (d) $(x - 3)$

$f(-1) = 3(-1)^2 - 7(-1) - 6$

$= 3 + 7 - 6$

$= 4$

$3x^2 - 7x - 6$

$f(3) = 3 \cdot 3^2 - 7 \cdot 3 - 6$

$= 27 - 21 - 6$

$= 0$

Time Consumption

- **Smart Way:** calculator

$x^2 - x - 6$

1. Write the total function f(x) on your scientific calculator.
2. Make this function an equation by adding '=0' at last part (you can get = sign by pressing 'Alpha' and then 'CALC' button).
3. Click 'Shift' and then 'CALC'
4. Repeat point 3 again
5. BOOM! You got a value of *a*

Alpha $\boxed{}$

$\boxed{\text{ON}}$

$=$

$x^2 - x - 6 = 0$ $\boxed{)}$

3

x ?

EXAMPLES

Example : 1 $3a^3 + 2a + 5$

Example : 2 $x^3 + 2x^2 - 5x - 6$

Example : 3 $4a^4 + 12a^3 + 7a^2 - 3a - 2$

Example : 4 $a^3 - 7a^2b + 7a^2 - b^3$

Example : 5 $x^6 - x^5 + x^4 - x^3 + x^2 - x$

EXAMPLE

- Example-1 : $3a^3 + 2a + 5$

$f(a) = 3a^3 + 2a + 5$

$f(-1) = 3(-1)^3 + 2(-1) + 5$

$f(-1) = -3 - 2 + 5 = 0$

$(a+1)$, factor of $f(a)$

$2^{2020} - 2^{2019}$

$= 2^{2019}(2-1)$

$2^{2019}(1)$

$= 2^{2019}$

$2^{2020} = 2^{2019} \cdot 2$

$3a^3 + 2a + 5$

$= 3a^3 + 3a^2 - 3a^2 - 3a + 5a + 5$

$= 3a^2(a+1) - 3a(a+1) + 5(a+1)$

$= (a+1)(3a^2 - 3a + 5)$

$2^{2020} - 2^{2019} = ?$

(a) 2 (d) 2^{2020}

(b) 0 (e) 2^{2019}

(c) 1 (f) none of the above

GRAPHICAL EXPLANATION:

Example- 1: $3a^3 + 2a + 5 = f(a)$

$f(-1) = 0$

$a+1$

$a = -1$

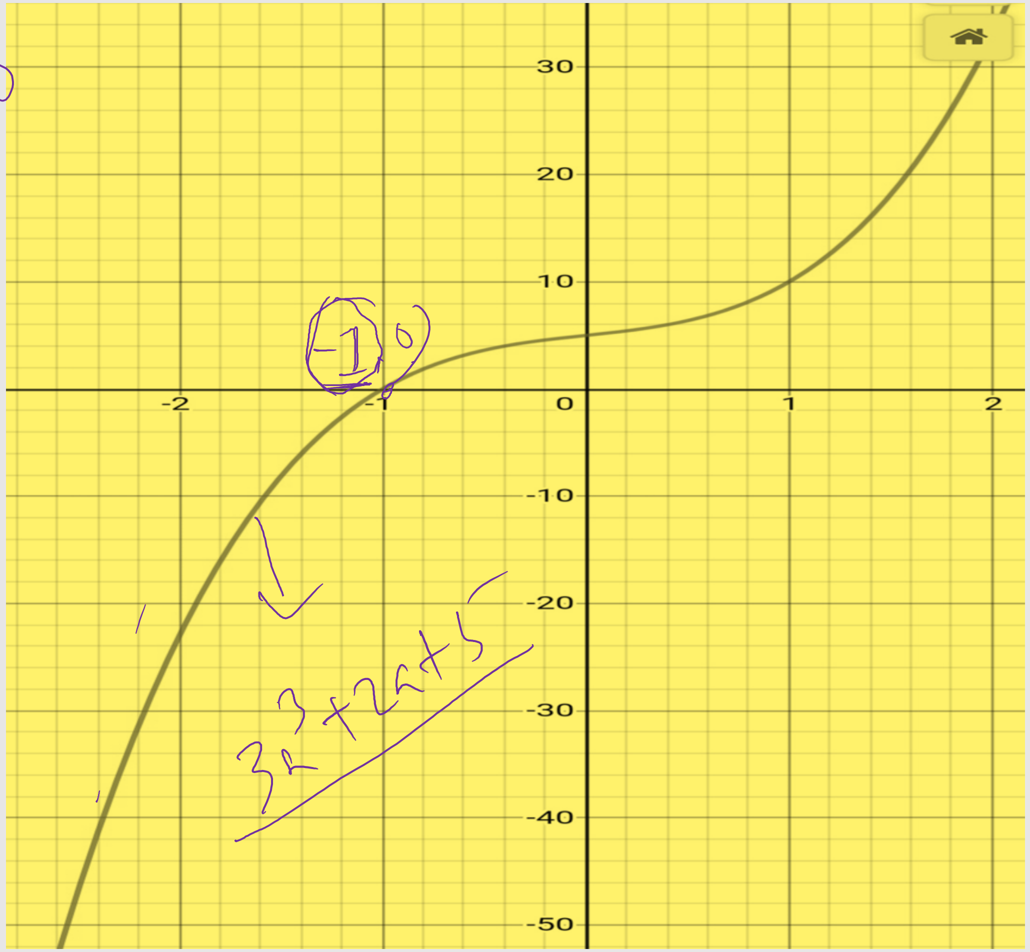
$(-1, 0)$

$a = -1$

$a+1 = 0$

$a = -1$

$a+1$



EXAMPLES

- Example : 2 $x^3 + 2x^2 - 5x - 6 = f(x)$

$f(2) = 2^3 + 2\cdot 2^2 - 5\cdot 2 - 6$

$= 8 + 8 - 10 - 6$

$= 0$

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

$x^3 + 2x^2 - 5x - 6$

$= x^3 - 2x^2 + 4x^2 - 8x + 3x - 6$

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

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

$= (x-2)\{x^2+3x+x+3\}$

$= (x-2)\{x(x+3)+1(x+3)\}$

$= (x-2)(x+3)(x+1)$

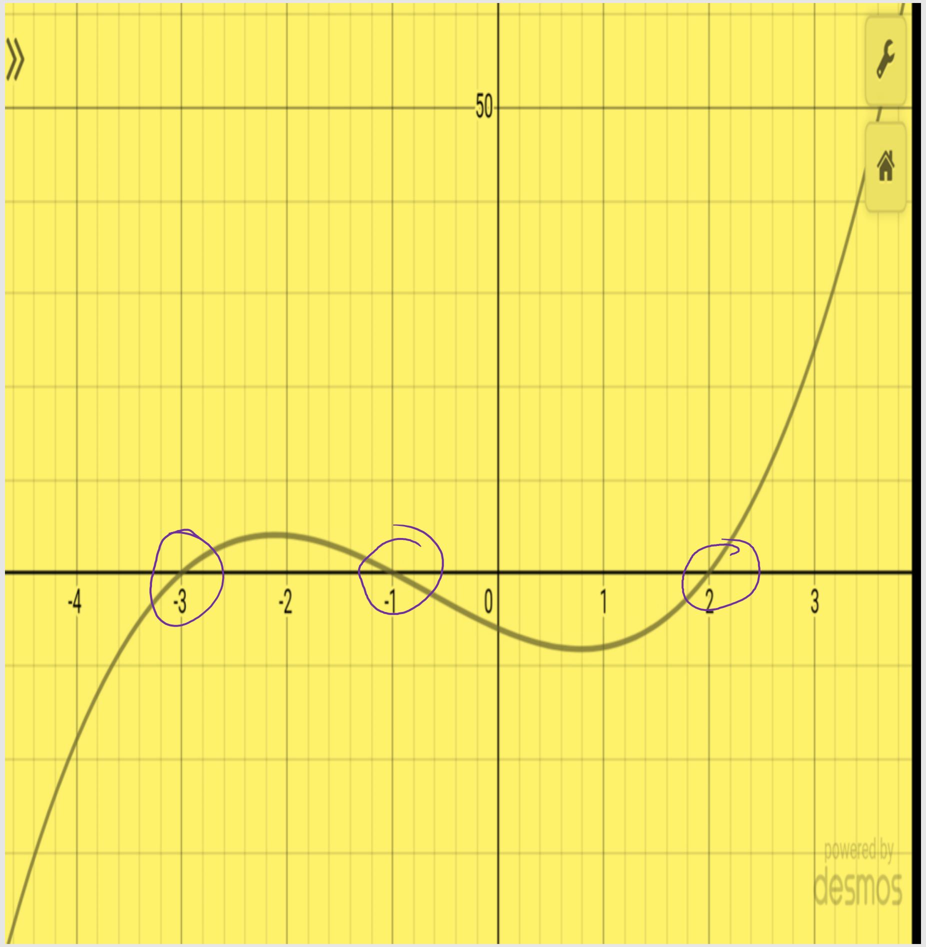
GRAPHICAL EXPLANATION:

Example : 2 $x^3 + 2x^2 - 5x - 6$

$x+3=0$
$x=-3$

$x-2=0$
$x=2$

$x+1=0$
$x=-1$



Poll 5

$(2x+1)(3x+2)(3x-1)$

- The abscissas of the points where the graph of f(x)=$18x^3 + 15x^2 - x - 2$ will intersect are-

a) -0.5,$\frac{-2}{3}, \frac{-1}{3}$

$b)$ $\frac{1}{2}, \frac{2}{3}, \frac{1}{3}$

$c)$ $\frac{-1}{2}, \frac{-2}{3}, \frac{1}{3}$

$d)$ $\frac{1}{2}, \frac{2}{3}, \frac{-1}{3}$

EXAMPLE

- Example : 3 $4a^4 + 12a^3 + 7a^2 - 3a - 2$ $= f(a)$

$f(-1) = 4(-1)^4 + 12(-1)^3 + 7(-1)^2 - 3(-1) - 2$

$= 0$

$(a+1)$ is a factor of $f(a)$

$4a^4 + 12a^3 + 7a^2 - 3a - 2$

$= 4a^4 + 4a^3 + 8a^3 + 8a^2 - a^2 - a - 2a - 2$

$= 4a^3(a+1) + 8a^2(a+1) - a(a+1) - 2(a+1)$

$= (a+1)(4a^3 + 8a^2 - a - 2)$

$= (a+1)(4a^3 + 8a^2 - a - 2)$

$= (a+1)\{4a^2(a+2) - 1(a+2)\}$

$= (a+1)(a+2)(4a^2 - 1)$

$= (a+1)(a+2)\{(2a)^2 - (1)^2\}$

$= (a+1)(a+2)(2a+1)(2a-1)$

EXAMPLE

Example : 4 $a^3 - 7a^2b + 7ab^2 - b^3 = f(a)$

$101 - 102 = 1$

$f(a) = a^3 - 7a^2b + 7ab^2 - b^3$

$f(b) = b^3 - 7b^2 \cdot b + 7b \cdot b^2 - b^3$

$= b^3 - 7b^3 + 7b^3 - b^3$

$= 0$

$(a-b)$ is a factor of $f(a)$

$a^3 - 7a^2b + 7ab^2 - b^3$

$= a^3 - a^2b - 6a^2b + 6ab^2 + ab^2 - b^3$

$= a^2(a-b) - 6ab(a-b) + b^2(a-b)$

$= (a-b)(a^2 - 6ab + b^2)$

EXAMPLE:

Example : 5 $x^6 - x^5 + x^4 - x^3 + x^2 - x = f(x) \rightarrow (x-1)$ is a factor of $f(x)$

$$= x(x^5 - x^4 + x^3 - x^2 + x - 1)$$

$$= x(x^5 - x^4 + x^3 - x^2 + x - 1)$$

$$= x\{x^4(x-1) + x^2(x-1) + 1(x-1)\}$$

$$= x\{(x-1)(x^4 + x^2 + 1)\}$$

$$= x(x-1)\{(x^2)^2 + 2 \cdot x^2 \cdot 1 + 1^2 - x^2\}$$

$$= x(x-1)\{(x^2+1)^2 - x^2\}$$

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

লেগে থাকো সৎভাবে,
স্বপ্ন জয় তোমারই হবে

উদ্ভাস-উন্মেষ শিক্ষা
পরিবার

$101 - 10^2 = 1$

Thank You