

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

বিস্মিল্লাহির রাখমানির রাহীম

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একাডেমিক এন্ড এডমিশন
কেয়ার

POLL 1

$$\begin{array}{r} 6 \longdiv{132} \\ \underline{-12} \\ 1 \end{array}$$

$$\begin{array}{r} 6 \longdiv{133} \\ \underline{-12} \\ -5 \end{array}$$

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

a)-3 \times

b)3 \times

c)-4 \circlearrowleft

d)0

e)None of above

$$3 \longdiv{-11} \quad -3$$

$$\begin{array}{r} -9 > -11 \end{array}$$

$$\begin{array}{r} 6 \longdiv{131} \\ \underline{-12} \\ 1 \end{array}$$

$$3 \longdiv{-11} \quad -4$$

$$\begin{array}{r} 3 \longdiv{-11} \quad 3 \\ \underline{-9} \\ -2 \end{array}$$

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

$$3) -11 \quad (-5$$

A handwritten red diagram illustrating the division of -11 by 3. It shows the divisor 3 in a bracket above the dividend -11. A horizontal line with a bar over it separates the dividend from the quotient. The quotient -3 is written above the line. A curved arrow points from the number 1 down to a circled remainder of -5.

What is Remainder? $x-2=0 \therefore (x=2)$

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

$x-3 \rightarrow$

\downarrow

$3 - 3 3 2$

$2 - 2 2$

$1 - 1 1$

$0 - 0 0$

Suppose, the dividend is

And with them, the quot

So, we can say,

$$f(x) = (x-a) \cdot h(x) + n$$

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.

$$n+2 \stackrel{?}{=} f(-2)$$

$$f(x) = (1-a) h(x) + r$$

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

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

s $h(x)$ and the remainder is r

$$\begin{array}{r} x-2 \\ \overline{x^2 - 8x + 6} \\ x - 2x \\ \hline -6x + 6 \\ -6x + 12 \\ \hline (+) (-) \\ -6 \end{array}$$

$f(2) = R$

with a , we get,

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

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

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

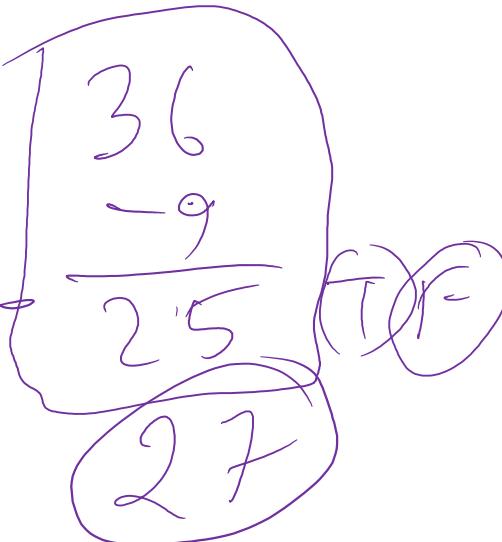
(d) 19

$x=3$

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

$= 27 - 3 - 6$

$= 18$



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 $a \neq 0$, then if you divide $f(x)$ by $(ax + b)$, the remainder will be $f(-b/a)$

$$\begin{array}{r} 6 \\ \times 3 \\ \hline 18 \\ 18 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 6 \\ \times 2 \\ \hline 12 \\ 12 \\ \hline 0 \end{array}$$

$$\begin{array}{lll} f(u) & (u-2) & f(2) \\ f(u) & (2u+3) & f(-\frac{3}{2}) \\ f(u) & \xrightarrow{(u-a)} & f(a) \end{array}$$

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

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

~~$$\begin{array}{r} x^2 - x - 6 \\ \times 2 \\ \hline 2x^2 - 2x \\ -x^2 + x \\ \hline 0 \end{array}$$~~
$$f(-3) = 0$$

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

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

$$\begin{aligned} f(u) &= x^2 - x - 6 \\ f(-2) &= (-2)^2 - (-2) - 6 \\ &= 4 + 2 - 6 = 0 \end{aligned}$$

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) $(x - 2)$ \checkmark (d) $(x - 3)$

$$\begin{aligned}f(-1) &= 3(-1)^2 - 7(-1) - 6 \\&= 3 + 7 - 6 \\&= 4\end{aligned}\quad \begin{aligned}f(3) &= 3 \cdot 3^2 - 7 \cdot 3 - 6 \\&= 27 - 21 - 6 \\&= 0\end{aligned}$$

$$3x^2 - 7x - 6$$

Time Consumption

- **Smart Way:** calculator

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

$$\underline{x^2 - x - 6}$$



$$x^2 - x - 6 = 0 \quad \square$$

X

?

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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 $f(a)$

$$\begin{array}{r} 2^{2020} - 2^{2019} \\ \hline 2^{2019} - 2^{2018} \\ \hline \end{array}$$

$$\begin{array}{r} 2^{2019} - 2^{2018} \\ \hline 2^{2018} - 2^{2017} \\ \hline \end{array}$$

$$\vdots$$

$$\begin{array}{r} 2^{2} - 2^{1} \\ \hline 2^{1} - 2^{0} \\ \hline \end{array}$$

$$\begin{aligned} & 3a^3 + 2a + 5 \\ &= 3\underline{a^3} + 3\underline{a^2} - 3\underline{a^2} - 3\underline{a} + 5a + 5 \\ &= 3a\underline{(a+1)} - 3a\underline{(a+1)} + 5\underline{(a+1)} \\ &= (a+1) (3a^2 - 3a + 5) \end{aligned}$$

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

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

(b) 0

(c) 1

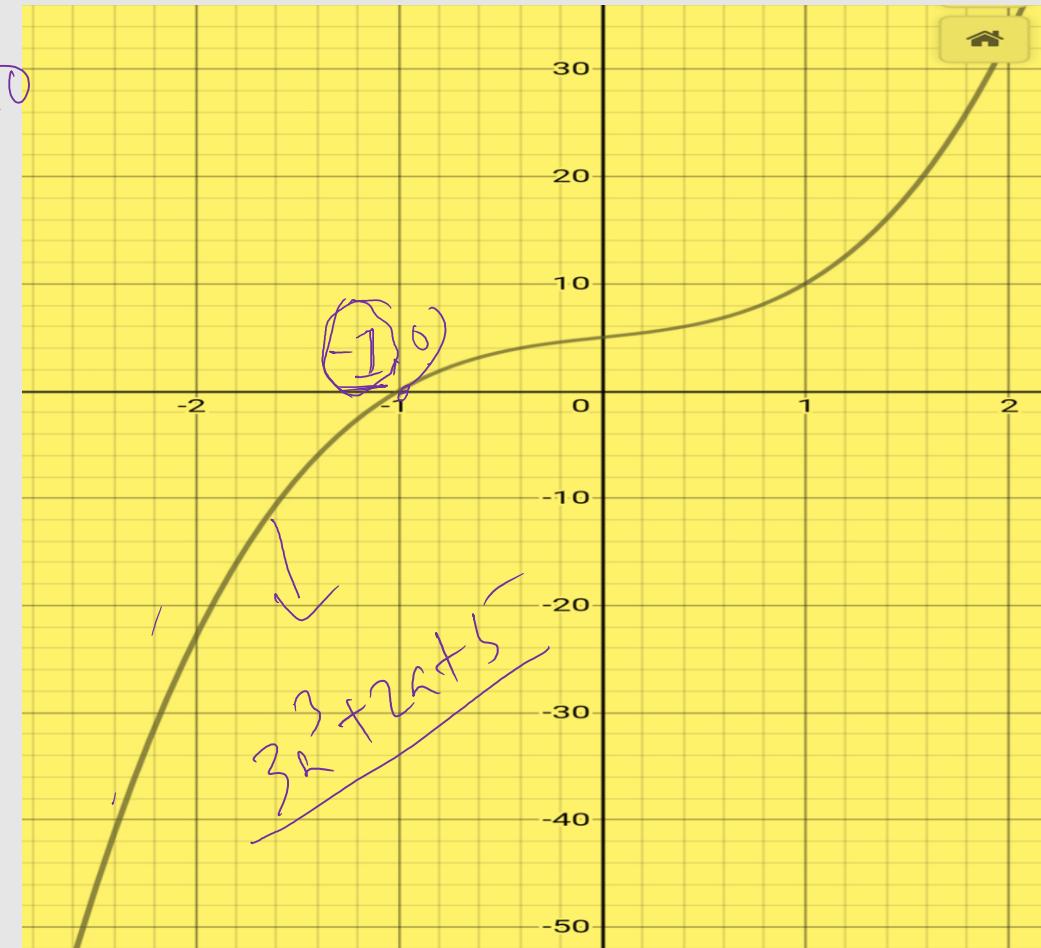
(e) 2^{2019}

(f) none of the above

GRAPHICAL EXPLANATION:

Example- 1:

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



EXAMPLES

• Example : 2

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

$$\begin{aligned}f(2) &= 2^3 + 2 \cdot 2^2 - 5 \cdot 2 - 6 \\&= 8 + 8 - 10 - 6 \\&= \underline{\underline{0}}\end{aligned}$$

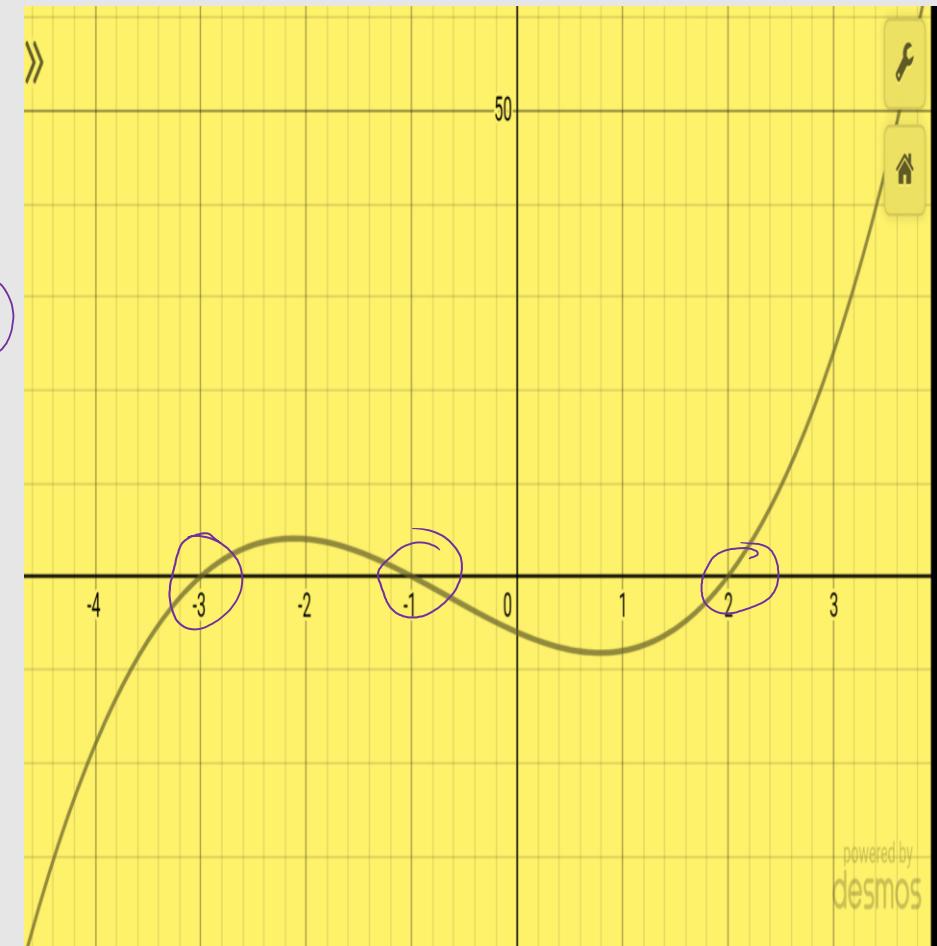
$(x-2)$ is a factor of $f(x)$

$$\begin{aligned}x^3 + 2x^2 - 5x - 6 &= f(x) \\&= x^3 - 2x^2 + 4x^2 - 8x + 3x - 6 \\&= x(x-2) + 4x(x-2) + 3(x-2) \\&= (x-2)(x^2 + 4x + 3) \\&= (x-2)(x+3)(x+1)\end{aligned}$$

GRAPHICAL EXPLANATION:

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

$$\begin{aligned}x+3 &= 0 \\x &= -3\end{aligned}$$
$$\begin{aligned}x-2 &= 0 \\x &= 2\end{aligned}$$
$$\begin{aligned}x+1 &= 0 \\x &= -1\end{aligned}$$



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

$$\begin{aligned}
 & 4a^4 + 12a^3 + 7a^2 - 3a - 2 = f(a) \\
 & f(-1) = 4(-1)^4 + 12(-1)^3 + 7(-1)^2 - 3(-1) - 2 \\
 & = 4 + 12(-1) + 7 - 3 - 2 \\
 & = 0
 \end{aligned}$$

$$\begin{aligned}
 & 4a^4 + 12a^3 + 7a^2 - 3a - 2 \\
 & = 4a^4 + 4a^3 + 8a^3 + 8a^2 - a - a - 2a - 2 \\
 & = 4a^3(a+1) + 8a^2(a+1) - a(a+1) - 2(a+1) \\
 & = (a+1)(4a^3 + 8a^2 - a - 2) \\
 & = (a+1)(4a^3 + 8a^2 - a - 2) \\
 & = (a+1)\{4a^2(a+2) - 1(a+2)\} \\
 & = (a+1)(a+2)(4a^2 - 1) \\
 & = (a+1)(a+2)\{(2a)^2 - 1^2\} \\
 & = (a+1)(a+2)(2a+1)(2a-1)
 \end{aligned}$$

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

EXAMPLE

Example : 4 $a^3 - 7a^2b + 7ab^2 - b^3 = f(a)$ $101 - 102 = 1$

$$f(a) = a^3 - 7\cancel{a}^2b + 7a\cancel{b}^2 - \cancel{b}^3$$

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

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

$$= 0$$

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

$$\begin{aligned} & a^3 - 7\cancel{a}^2b + 7a\cancel{b}^2 - \cancel{b}^3 \\ &= a^3 - ab - 6ab + 6ab + ab - b^3 \\ &= a(a-b) - 6ab(a-b) + b^2(a-b) \\ &= (a-b)(a^2 - 6ab + b^2) \end{aligned}$$

EXAMPLE:

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

$$\begin{aligned} &= x(x^5 - x^4 + x^3 - x^2 + x - 1) \\ &= x((x^5 - x^4 + x^3 - x^2 + x - 1) + 1) \\ &= x\{(x^4 - 1) + x(x^3 - x^2 + x - 1)\} \\ &= x\{(x^2 - 1)(x^2 + 1) + x(x^3 - x^2 + x - 1)\} \\ &= x(x-1)\{(x^2 + 1) + x(x^2 - 1 + 1 - x)\} \\ &= x(x-1)\{(x^2 + 1) - x(x^2 - 1)\} \\ &= x(x-1)\{(x+1) - x(x-1)\} \\ &= x(x-1)^2 \end{aligned}$$

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ଅନ୍ତର୍ଜାତି ତୋମାରଙ୍କ ହବେ

ଡକ୍ଟ୍ରାମ-ଉନ୍ନୟନ ଶିକ୍ଷା
ପରିବାର

$$101 - 10^2 = 1$$

Thank You