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CC ALGEBRA 2

Date: 10/10/17

TROICI

LESSON #9: THE REMAINDER THEOREM & FINDING A REMAINDER ON A GRAPH

Do Now: Consider the polynomial function $g(x) = x^3 - 3x^2 + 6x + 8$.

a. Divide g by $x + 1$.

$$x^2 - 4x + 10 + \frac{2}{x+1}$$

$$x+1 \overline{\big) x^3 - 3x^2 + 6x + 8}$$

$$-x^3 \overset{-}{\oplus} x^2$$

$$-4x^2 + 6x$$

$$+4x^2 + 4x$$

$$10x + 8$$

$$-10x \overset{-}{\oplus} 10$$

$$-2$$

OMG SAME!

b. Find $g(-1)$.

$$g(-1) = (-1)^3 - 3(-1)^2 + 6(-1) + 8$$

$$= -1 - 3 - 6 + 8$$

$$= -2$$

The remainder found after dividing P by $x - a$ will be the same value as $P(a)$

If p(a) = 0, then (x – a)is a factor

What do we suspect about the connection between the remainder from dividing a polynomial P by $x - a$ and the value of $P(a)$?

Factor ↑ Root ↑

1) Consider the polynomial: $P(x) = x^4 + 3x^3 - 28x^2 - 36x + 144$. Is $x + 3$ one of the factors of P?

Root = −3

$$P(-3) = (-3)^4 + 3(-3)^3 - 28(-3)^2 - 36(-3) + 144$$

$$= 81 - 81 - 252 + 108 + 144$$

$$= 0$$

yes x + 3 is a factor. b/c it satisfies the Poly. remainder theorem

2) When $x^3 + kx^2 - 4x + 2$ is divided by $x + 2$, the remainder is 26. Find k.

Root = −2

$$P(-2) = 26$$

$$(-2)^3 + k(-2)^2 - 4(-2) + 2 = 26$$

$$\cancel{-8} + 4k \cancel{+8} + 2 = 26$$

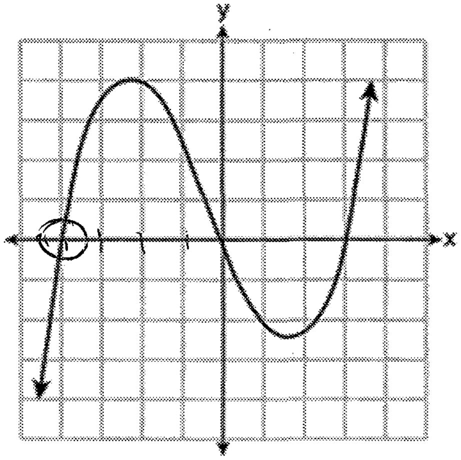
$$4k + 2 = 26$$

$$4k = 24$$

$$\boxed{k = 6}$$

3) The graph of p(x) is show in the accompanting diagram. What is the remiander when p(x) is divided by x + 4? → Root = -4

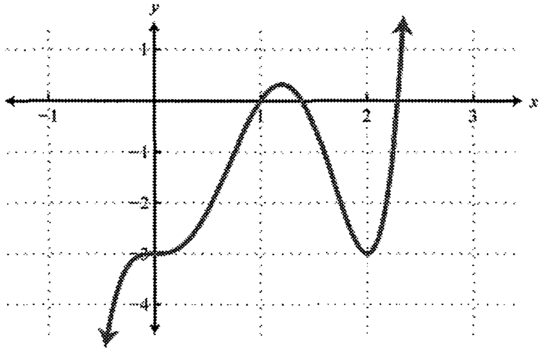
1) x − 4
2) -4
[✓ 3) 0] -4 is a root so there is no remainder!
4) 4



4) The graph of a polynomial function is illustrated below. What is the remainder when p(x) is divided by (x - 2)? Root = 2 -3?

Find P(2)
in other words, Find the y-value when x=2

$P(2) = \boxed{-3} \rightarrow$ remainder!



5) Consider the polynomial function: $P(x) = x^3 - 8x^2 - 29x + 180$. If P(9) = 0, find the remaining two factors of P. ↳ means x-9 is a factc

①

$$
\begin{array}{r}
x^2 + x - 20 \\
x-9 \overline{) x^3 - 8x^2 - 29x + 180} \\
\underline{-x^3 + 9x^2} \\
1x^2 - 29x \\
\underline{-x^2 + 9x} \\
-20x + 180 \\
\underline{+20x \mp 180} \\
0
\end{array}
$$

② $x^2 + \overset{a}{x} \overset{m}{-20}$

$(x+5)(x-4)$

$\{(x+5)(x-4)(x-9)\}$

6) If $p(a)$ is the remainder when $x^3 + 3x^2 - 18x - 40$ is divided by $x - a$, for which value of a would $p(a) = 0$? Guess & check or factor OR calculator (Fastest)

(~~A~~) 2 [✓ (B) -2] (~~C~~) 3 (~~D~~) -3

Practice:

7) Use the Remainder Theorem to find the remainder for the following division.

$(k^3 - k^2 - k - 2) \div (k - 2)$

$P(2) = (2)^3 - (2)^2 - (2) - 2$

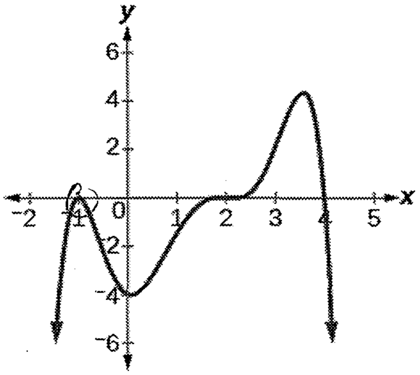
$8 - 4 - 2 - 2 = 0$

$\boxed{\text{Remainder} = 0}$

8) The graph of a polynomial function, M(x), is illustrated below. What is the remainder when M(x) is divided by x+1? $-1 = \text{root}$

$P(-1) = 0$

$\boxed{\text{Remainder} = 0}$



9) Find *a* such that $2x+5$ will be a factor of $4x^3 + 8x^2 + ax + 30$.

$2x + 5 = 0$

$\underline{\quad -5 \quad -5}$

$2x = -5$

$x = \frac{-5}{2}$ (root)

want $P(-\frac{5}{2}) = 0$ OR $P(-2.5) = 0$

$4(-2.5)^3 + 8(-2.5)^2 + a(-2.5) + 30 = 0$

$-\underline{62.5} + \underline{50} - 2.5a + \underline{30} = 0$

$17.5 - 2.5a = 0$

$-2.5a = -17.5$

$\boxed{a = -7}$

10) Determine if x – 5 is a factor of $2x^3 - 4x^2 - 7x - 10$. Explain your answer.

Root = 5

$P(5) = 2(5)^3 - 4(5)^2 - 7(5) - 10$

$= 250 - 100 - 35 - 10$

$= \boxed{105}$

No, x-5 is not a factor b/c it has a remainder of 105.