February 12

GUIDED NOTES: Polynomial Applications

EX1. For 1985 through 1996, the number, C (in millions), of videos rented each year in the United States can be modeled by $C = 0.053\left(t^3 + 2t^2 + 33t + 500\right)$, where $t = 0$ represents 1990. Using this model, estimate the number of videos rented in the United States in 1994.

$1994 - 1990 = 4 = t$

$C = 0.053\left((4)^3 + 2(4)^2 + 33(4) + 500\right)$

$C = \boxed{38.58 \text{ million videos}}$

EX2. The profit P (in millions of dollars) for a manufacturer of MP3 players can be modeled by $P = -4x^3 + 12x^2 + 16x$, where x is the number of MP3 players produced (in millions). Currently, the company produces 3 million MP3 players and makes a profit of $48,000,000. What lesser number of MP3 players could the company produce and still make the same profit?

$P = 48$

$48 = -4x^3 + 12x^2 + 16x$
$-48 \qquad\qquad\qquad -48$

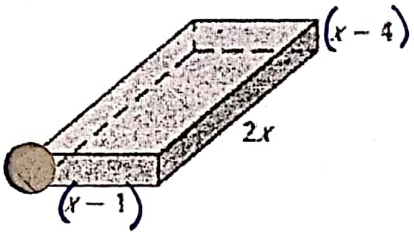
$0 = -4x^3 + 12x^2 + 16x - 48$

$x = \cancel{-2}, 2, \cancel{3}$ ← not the lesser amount

↑ can't have negative MP3 players

$\boxed{\text{2 million MP3 players}}$

EX3. Given that the volume of the box is 40 in^3, determine the dimensions of the box.



$V = L \cdot w \cdot h$

$40 = 2x(x-4)(x-1)$
$-40 \qquad\qquad -40$

$0 = 2x(x-4)(x-1) - 40$

$x = 5$

$(5) - 4 = \boxed{1 \text{ in}}$

$2(5) = \boxed{10 \text{ in}}$

$(5) - 1 = \boxed{4 \text{ in}}$

EX4. A rectangular pool has a length of $\underbrace{x^2 + 9x + 3}_{L}$ feet and a width of $\underbrace{4x - 2}_{w}$ feet. Determine the area of the pool.

$A = L \cdot w$

$(x^2 + 9x + 3) \cdot (4x - 2)$

$4x^3 - 2x^2 + 36x^2 - 18x + 12x - 6$

$\boxed{4x^3 + 34x^2 - 6x - 6}$

EX5. A rectangular Tyrannosaurus Rex paddock has an area of $\underbrace{x^3 + x^2 - 11x + 4}_{A}$ square meters, and a width of $\underbrace{x + 4}_{w}$ meters. Find its length.

$\frac{A}{w} = \frac{L \cdot \cancel{w}}{\cancel{w}}$

$(x^3 + x^2 - 11x + 4) \div (x + 4)$

$x + 4 = 0$
$-4 \quad -4$

$x = -4$

-4	1	1	-11	4
	0	-4	12	-4
	1	-3	1	0

0 ← Remainder

$\boxed{x^2 - 3x + 1}$

NAME ____ $m = \frac{y_2 - y_1}{x_2 - x_1}$

Average Rate of Change

1. Find the average rate of change from ***x* = – *1*** to ***x* = 2** for each of the functions below.

a. $a(x) = 2x + 3$

$2(-1)+3=1$ ① $(\overset{x_1}{-1}, \overset{y_1}{1})$

$2(2)+3=7$ ② $(\underset{x_2}{2}, \underset{y_2}{7})$

$\frac{(7)-(1)}{(2)-(-1)} = \boxed{2}$

b. $b(x) = x^2 - 1$

$(-1)^2-1=0$ ① $(\overset{x_1}{-1}, \overset{y_1}{0})$

$(2)^2-1=3$ ② $(\underset{x_2}{2}, \underset{y_2}{3})$

$\frac{(3)-(0)}{(2)-(-1)} = \boxed{1}$

c. $c(x) = 2^x + 1$

$2^{(-1)}+1=1.5$ ① $(\overset{x_1}{-1}, \overset{y_1}{1.5})$

$2^{(2)}+1=5$ ② $(\underset{x_2}{2}, \underset{y_2}{5})$

$\frac{(5)-(1.5)}{(2)-(-1)} = \boxed{1.17}$

d. Which function has the greatest average rate of change over the interval **[– 1, 2]**?

$a(x) = 2x+3$

2. Find the average rate of change on the interval **[2, 5]** for each of the functions below.

a. $a(x) = 2x + 1$

b. $b(x) = x^2 + 2$

c. $c(x) = 2^x - 1$

d. Which function has the greatest average rate of change over the interval ***x* = 2** to ***x* = 5**?

3. In general as $\underbrace{x \to \infty}_{\text{really big}}$, which function eventually grows at the fastest rate?

a. $a(x) = 2x$

b. $b(x) = x^2$

c. $c(x) = 2^x$

exponentials get really big really fast