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.

year 0

$1994 - 1990 = 4 = t$

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

$\boxed{38.584 \text{ million videos}}$

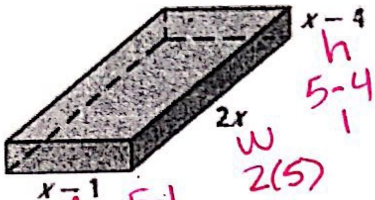
EX2. The profit P (in millions of dollars) for a manufacturer of MP3 players can be modeled by $P = -4x^3 + 12x^2 + 16x$, where x is the number of MP3 players produced (in millions). Currently, the company produces 3 million MP3 players and makes a profit of \$48,000,000. What lesser number of MP3 players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

48

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

$\boxed{\text{2 million mp3 players}}$

EX3. Given that the volume of the box is 40 in³, determine the dimensions of the box.



h: 5-4 = 1
w: 2(5) = 10
l: 5-1 = 4

$V = lwh$

$40 = (x-1)(2x)(x-4)$
$-40 \qquad\qquad -40$
$0 = (x-1)(2x)(x-4) - 40$
$x = 5$

$\boxed{4\text{in} \times 10\text{in} \times 1\text{in}}$

EX4. A rectangular pool has a length of $x^2 + 9x + 3$ feet and a width of $4x - 2$ feet. Determine the area of the pool.

$A = lw$

$A = lw$
$(x^2 + 9x + 3)(4x - 2)$
$4x^3 - 2x^2 + 36x^2 - 18x + 12x - 6$

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

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

$\frac{A}{w} = \frac{l\cancel{w}}{\cancel{w}}$

$x + 4 = 0$
$x = -4$

$$\begin{array}{r|rrrr} -4 & 1 & 1 & -11 & 4 \\ & \downarrow & -4 & 12 & -4 \\ \hline & 1 & -3 & 1 & 0 \end{array}$$

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

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$$\frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$$

NAME ________________________________

Average Rate of Change

1 2

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

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

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

$\frac{6}{3} = \boxed{2}$

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

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

$\frac{3}{3} = \boxed{1}$

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

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

$\frac{3.5}{3} = \boxed{1.167}$

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

A

12

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 $x \to \infty$, which function eventually grows at the fastest rate?

zoom out!

a. $a(x) = 2x$

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

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

4. Find the average rate of change from $x = -1$ to $x = 2$ for each of the continuous functions below based on the partial set of values provided.

a.

x	−1	0	1	2	3
$a(x)$	−3	−2	1	6	13

b.

x	−1	0	1	2	3
$b(x)$	1	3	5	7	9

c.

x	−1	0	1	2	3
$c(x)$	−2	−1	1	5	13

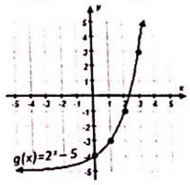
d. Which function has the greatest average rate of change over the interval **[− 1, 2]**?

5. Consider the table below that shows a partial set of values of two continuous functions. Based on any interval of x provided in the table which function always has a larger average rate of change?

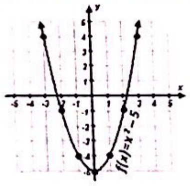
x	$f(x)$	$g(x)$
−1	−2	−4
0	0	0
1	3	8
2	7	24

6. Find the average rate of change from $x = 1$ to $x = 3$ for each of the functions graphed below.

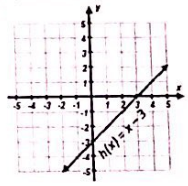
a.



b.



c.



d. Which function has the greatest average rate of change over the interval **[1, 3]**?