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Mr. Varughese - Alg2 Midterm Review

1. An object is launched from a platform that is 80 feet above the ground. The height of the object is a function of time $h(t) = -16t^2 + 64t + 80$, where h is measured in feet and t is time in seconds. *If you choose to solve this problem graphically, be sure to support your solution with a sketch or table and the proper labeling of all parts.*

   a. At what time does the object reach its maximum height?

$$t = \frac{-b}{2a}$$

$$t = \frac{-(64)}{2(-16)}$$

$$\boxed{t = 2 \text{ seconds}}$$

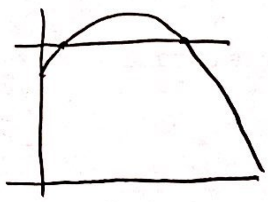
   b. What is the maximum height the ball will reach?

$$h(2) = -16(2)^2 + 64(2) + 80$$

$$h(2) = 144$$

$$\boxed{144 \text{ feet}}$$

   c. For how many seconds, to the nearest hundredth, will the ball be above 125 feet?



$t = .91027526$

$t = 3.0897247$

> 2.17944944

$$\boxed{2.18 \text{ seconds}}$$

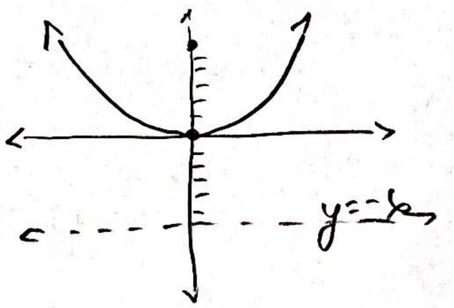
2. Factor and reduce the following rational expression: $\frac{3x-x^2}{9-x^2}$

$$\frac{x\cancel{(3-x)}}{(3+x)\cancel{(3-x)}}$$

$$\boxed{\frac{x}{3+x}}$$

3. Write and equation of a parabola with the given characteristics, sketch a graph for full credit:

   Focus: (0, 6) directrix: y = -6



$$y = \frac{1}{4p}(x-h)^2 + k$$

$$y = \frac{1}{4(6)}(x-0)^2 + 0$$

$$\boxed{y = \frac{1}{24}x^2}$$

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4. Identify the transformation, in function notation, of a parabola with a vertex of $(-1,3)$ to a parabola with a vertex of $(2,4)$.

$(-1,3) \xrightarrow[\text{up } 1]{\text{rt } 3} (2,4)$

$\boxed{f(x-3)+1}$

5. Simplify each expression:

a. $3\sqrt{32}$

$3\sqrt{16}\sqrt{2}$

$3 \cdot 4\sqrt{2}$

$\boxed{12\sqrt{2}}$

b. $\sqrt{-36}$

$\sqrt{36}\sqrt{-1}$

$\boxed{6i}$

c. $2\sqrt{-20}$

$2\sqrt{-4}\sqrt{5}$

$2 \cdot 2i\sqrt{5}$

$\boxed{4i\sqrt{5}}$

6. Sketch a scatter plot of a linear regression with an r-value close to -1.

7. Solve the equation using the quadratic formula, express your answer in simplest $a + bi$ form:

$$x^2 + 4x = -5$$

$x^2+4x+5=0$

$a=1$
$b=4$
$c=5$

$x = \dfrac{-b \pm \sqrt{b^2-4ac}}{2a}$

$x = \dfrac{-(4) \pm \sqrt{(4)^2-4(1)(5)}}{2(1)}$

$x = \dfrac{-4 \pm \sqrt{-4}}{2}$

$x = \dfrac{-4 \pm 2i}{2}$

$x = -\dfrac{4}{2} \pm \dfrac{2i}{2}$

$\boxed{x = -2 \pm i}$

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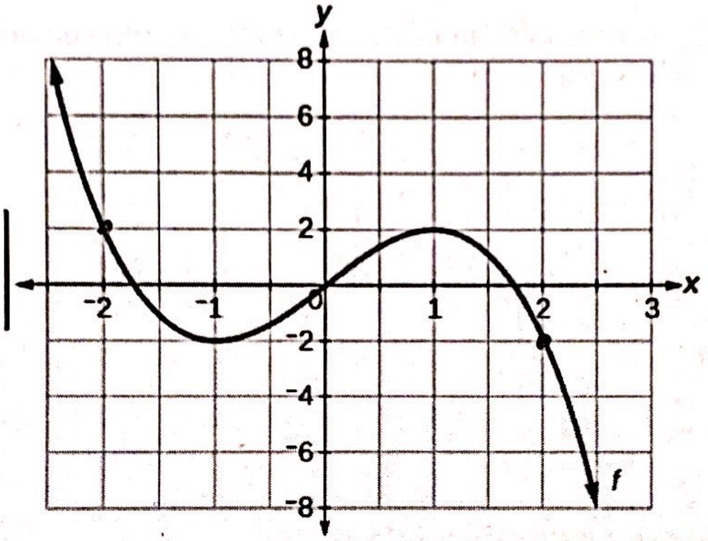
8. Factor the perfect square trinomial: $x^2 - 7x + \frac{49}{4}$

$\boxed{(x - 7/2)^2}$

9. Find the average rate of change over the interval $-2 \le x \le 2$ for the graph given below.



$(-2, 2)$
$(2, -2)$

$\frac{-2 - 2}{2 - -2}$

$= \frac{-4}{4}$

$= \boxed{-1}$

10. The expression $4i^3(2i + 3)$ is equivalent to what simplified expression?

$i^4 = 1$

$i^3 = -i$

$4i^3(2i + 3)$

$8i^4 + 12i^3$

$8(1) + 12(-i)$

$\boxed{8 - 12i}$

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11. Find algebraically, the zeros for $p(x) = x^3 + 2x^2 - 4x - 8$.

$0 = x^3 + 2x^2 - 4x - 8$

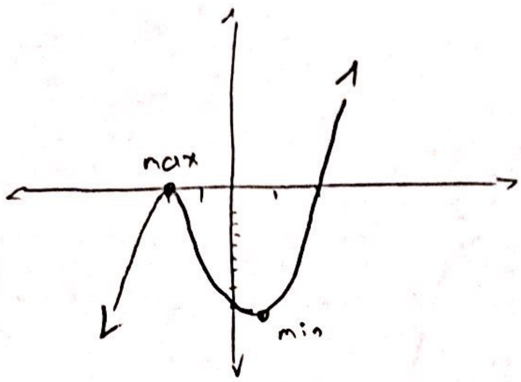
$0 = x^2(x+2) - 4(x+2)$

$0 = (x+2)(x^2-4)$

$0 = (x+2)(x+2)(x-2)$

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

Sketch the graph $y = p(x)$; using the calculator determine to the nearest hundredth the relative maximum and the relative minimum.

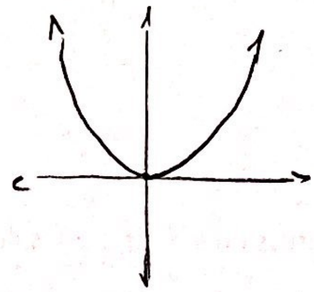


relative max: $(-2, 0)$

relative min: $(.67, -9.48)$

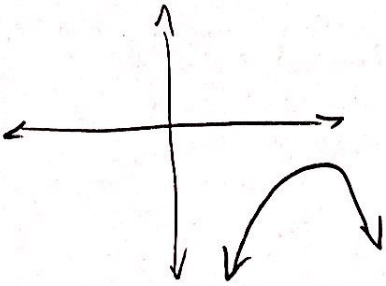
12. What is an even function? Draw a sketch of one below:

- symmetric about the y axis.
- $f(x) = f(-x)$



13. If the discriminant is less than zero, sketch a graph the best representation of $y = ax^2 + bx + c$.

$b^2 - 4ac < 0$, does not hit the x axis.



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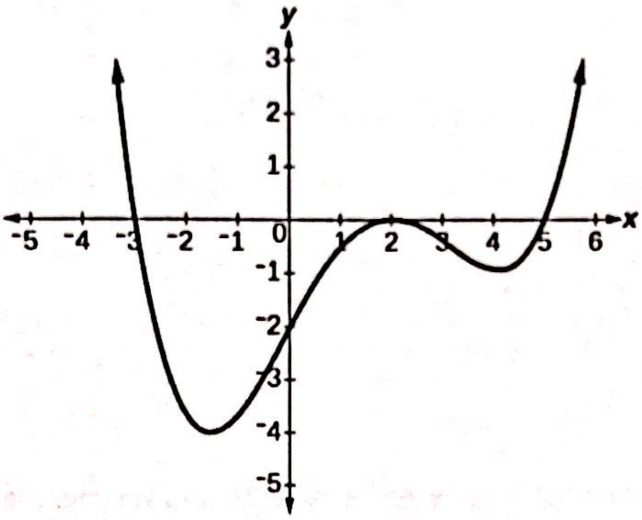
14. The graph of $f(x)$ is shown below. What is the remainder when $f(x)$ is divided by:

a. $(x-2)$
b. (x)
c. $(x-4)$
d. $(x+3)$

a.	0	$= f(2)$
b.	-2	$= f(0)$
c.	-1	$= f(4)$
d.	0	$= f(-3)$



15. Solve and check the following rational equation:

$$3x\left[\frac{5}{x}-\frac{1}{3}=\frac{1}{x}\right]$$

$15 - 1x = 3$

$+x \quad +x$

$15 = x + 3$

$-3 \quad -3$

$\boxed{12 = x}$

CHECK:

$\frac{5}{12} - \frac{1}{3} = \frac{1}{12}$

$\frac{5}{12} - \frac{4}{12}$

$\frac{1}{12} = \frac{1}{12}$ ✓

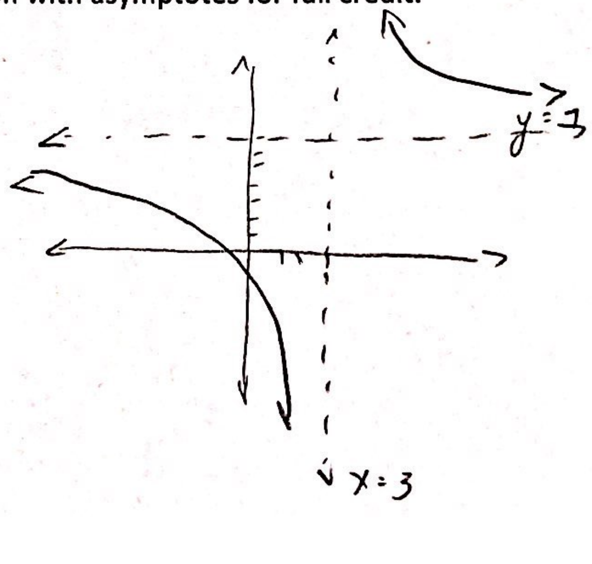
16. Using long division, convert $f(x) = \frac{7x+4}{x-3}$ into the $f(x) = \frac{a}{x-h} + k$ form, and state the Domain and the Range. Include a sketch of a graph with asymptotes for full credit.

$$\begin{array}{r} 7 \\ x-3\,\overline{)\,7x+4} \\ -(7x-21) \\ \hline 25 \end{array}$$

$f(x) = 7 + \frac{25}{x-3}$

or

$f(x) = \frac{25}{x-3} + 7$



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17. Solve the non-linear system of equations using and algebraic technique:

$$y + 3x = -17$$
$$y = -3x^2 - 30x - 71$$

$y = -3x - 17$

$-3x - 17 = -3x^2 - 30x - 71$
$+3x + 17 \qquad +3x \quad +17$

$0 = -3x^2 - 27x - 54$
$\div 3$

$0 = x^2 + 9x + 18$

$0 = (x + 3)(x + 6)$

$x = -3 \quad | \quad x = -6$

$y = -3(-3) - 17$
$y = -8$
$\boxed{(-3, -8)}$

$y = -3(-6) - 17$
$y = 1$
$\boxed{(-6, 1)}$

18. Determine if $x + 3$ is a factor of $-2x^3 + 4x^2 + 8x + 10$. Explain your reasoning.

$-2(-3)^3 + 4(-3)^2 + 8(-3) + 10 \stackrel{?}{=} 0$

$-2(-27) + 4(9) - 24 + 10 \stackrel{?}{=} 0$

$54 + 36 - 24 + 10 \stackrel{?}{=} 0$

$90 - 14 \stackrel{?}{=} 0$

$76 \neq 0$

x + 3 is NOT a factor!