1) (2 points each) For the given points $(6,-2)$ and $(1,10)$, find…

a) The distance between them:

$d = \sqrt{(1-6)^2 + (10-(-2))^2}$

$= \sqrt{169} = 13$

b) Their midpoint:

$\left(\frac{6+1}{2}, \frac{-2+10}{2}\right) = \left(\frac{7}{2}, 4\right)$

c) Find the equation of the circle where $(6,-2)$ and $(1,10)$ are endpoints of a diameter of the circle:

$(x-7/2)^2 + (y-4)^2 = \left(\frac{13}{2}\right)^2 = \frac{169}{4}$

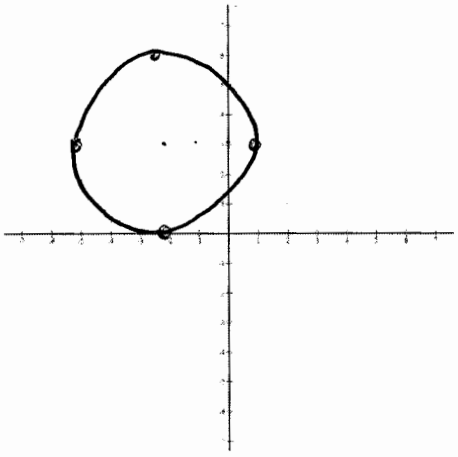
2) (2 points each) For the circle $(x+2)^2+(y-3)^2=9$…

a) Find the center and radius:

Center: $(-2,3)$

radius: 3

b) Sketch a graph:



3) (2 points) Find the equation of a line in slope-intercept form that passes through the point $(1,-5)$ and is perpendicular to $4x-9y=12$:

$4x-9y=12 \Rightarrow y = \frac{4}{9}x - \frac{4}{3}$ $\quad m = \frac{4}{9}$

$\perp m = -\frac{9}{4}$

$y-(-5) = -\frac{9}{4}(x-1) \Rightarrow \boxed{y = -\frac{9}{4}x - \frac{11}{4}}$

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4) (3 points each) Find the domain of the following functions:

a) $f(x)=6x^3+6x^2-4x-4$

$\mathbb{R}$

b) $g(x)=\dfrac{x^2+9}{x^2-9}$

$x^2-9=0$

$x^2=9$

$x\neq\pm 3$

c) $h(x)=\dfrac{-12}{\sqrt{3x-1}}$

$3x-1>0$

$x>1/3$

5) (5 points) It was found that the profit P from selling x tickets of *The Mythically Nice Professor* can be modeled by the function $P(x)=-2x^2+80x+15$ where P is in dollars. Find and interpret the average rate of change from the 8th to the 16th ticket sold.

$$\frac{P(16)-P(8)}{16-8}=\frac{783-527}{8}=32$$

Profit is increasing by \$32 per ticket from the 8th to the 16th ticket sold.

6) (3 points each) Consider the following data (source: Census.gov):

Year	2000	2005	2006	2007	2008	2009	2010	2014	2015
Population of Cleveland, Ohio (in thousands)	476	449	442	438	434	431	396	390	386

Let x be the number of years since 2000 and let y be the population of Cleveland, Ohio (in thousands).

a) Using the LinReg function on your calculator, find the equation of the regression line. Round values to two decimal places:

$y=-6.36x+479.19$

b) Interpret the slope and y-intercept using the language of the problem:

words go here!

c) Predict the population of Cleveland in 2020:

$2020 \Rightarrow x=20$

$-6.36(20)+479.19=$ 351.99 thousand

d) During what year will there be 250,000 people in Cleveland?

$250=-6.36x+479.19 \Rightarrow x=\dfrac{250-479.19}{-6.36}\approx 36.04$

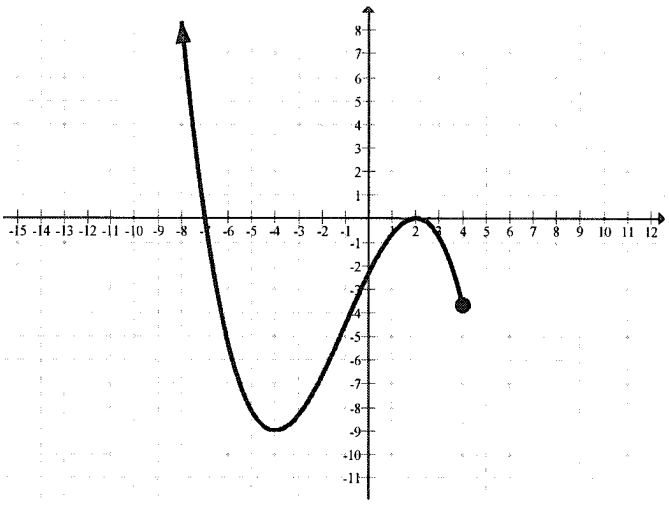
$+2000$

During 2036

7) (2 points each) For the given graph, find the following. Write parts $a-d$ in interval notation. For parts c and d, write in terms of x. For parts e and f, write answer as an ordered pair.

a) The Domain $(-\infty, 4]$

b) The Range $[-9, \infty)$



c) Increases $(-4, 2)$

d) Decreases $(-\infty, -4) \cup (2, 4)$

e) Relative Maximum(s) $(2, 0)$

f) Relative Minimum(s) $(-4, -9)$

8) (6 points) An evil math instructor wishes to punish students who think that working towards an answer is a good idea. He plans to build 5 adjacent, rectangular pens enclosed on all sides. He has 450 feet of fencing available. He needs to determine a function that will relate the area of the enclosure to the width x; however, he just started playing a video game and he wants you to find this function.

$6x + 2y = 450 \Rightarrow y = 225 - 3x$

$A = xy = x(225 - 3x)$

$A(x) = 225x - 3x^2$

9) (2 points each) For the functions $f(x) = 3x^2 + 1$ and $g(x) = \sqrt{5x - 7}$, find and simplify...

a) $(f+g)(x)$

$= 3x^2 + 1 + \sqrt{5x - 7}$

b) $(f \circ g)(x)$

$= 3(\sqrt{5x-7})^2 + 1$

$= 3(5x - 7) + 1$

$= 15x - 20$

c) The domain of $f \circ g$

$D_g: x \geq 7/5$

$D_f: \mathbb{R}$

$D_{f \circ g}: x \geq 7/5$

10) (3 points) Find two functions f and g such that $H = f \circ g$ where $H(x) = 8\sqrt{5x^2 + 12} + 7$:

$f(x) = 8\sqrt{x} + 7 \qquad g(x) = 5x^2 + 12$

multiple answers.

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11) (6 points) For the function $f(x)=4x^2-6x+5$, find and simplify $\frac{f(x+h)-f(x)}{h}$:

$$= \frac{4(x+h)^2-6(x+h)+5-(4x^2-6x+5)}{h}$$

$$= \frac{4x^2+8xh+4h^2-6x-6h+5-4x^2+6x-5}{h} = \frac{8xh+4h^2-6h}{h}$$

$$= \boxed{8x+4h-6}$$

12) (4 points) Determine if the function $f(x)=\frac{|x|-2}{x^2}$ is even, odd, or neither algebraically:

$$f(-x) = \frac{|-x|-2}{(-x)^2} = \frac{|x|-2}{x^2} \quad \text{Even.}$$

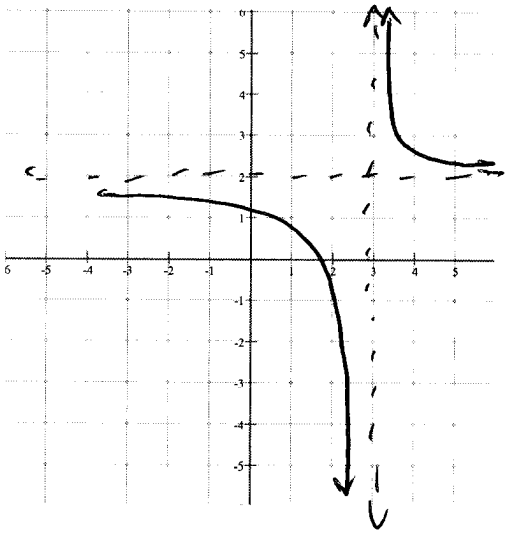
$$|-x| = |x| \qquad (-x)^2 = (x)(-x) = x^2$$

13) (3 points each) For the function $f(x)=\frac{4}{x-3}+2\ldots$

a) List the steps needed to sketch a graph:

1) Right 3
2) vertically stretch by 4
3) up 2.

b) Sketch a graph:



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14) (2 points each) Given the point $(-9,3)$ on the graph of $y=f(x)$, find the **exact value** of the coordinates of the point under the transformation below:

a) $y=f(x)+7$ b) $y=f(x+1)$ c) $y=f(-x)$ d) $y=3f(x)-2$

$(-9,10)$ $(-10,3)$ $(9,3)$ $(-9,7)$

15) (1 point each) Match the following functions with the best description or picture:

G Constant

C Linear

K Identity

B Cube

H Square

J Square root

A Cube root

E Greatest-integer

F Reciprocal

D Absolute value

I Piecewise-defined