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

a) The distance between them:

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

$= \sqrt{25+144} = \boxed{13}$

b) Their midpoint:

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

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

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

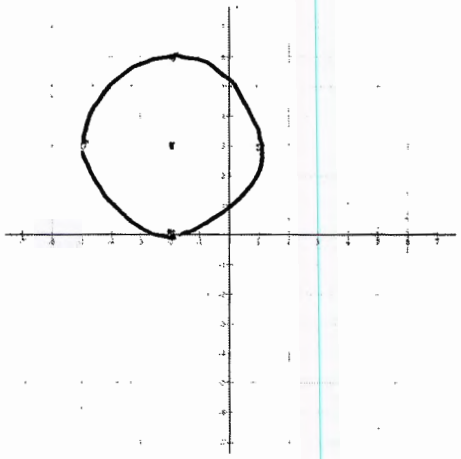
2) (2 points each) For the circle $(x+2)^2+(y-3)^2=9$…

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 $4x-9y=12$:

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

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

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

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

a) $f(x)=6x^3+6x^2-4x-4$ b) $g(x)=\frac{x^2+9}{x^2-9}$ c) $h(x)=\frac{-12}{\sqrt{3x-1}}$

$\mathbb{R}$

$x^2-9=0$

$x\neq\pm 3$

$3x-1>0$

$x>\frac{1}{3}$

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/ticket from the 8th to the 16th ticket sold.

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

Year	1990	1995	2000	2005	2006	2007	2008	2009	2010
Population of Cleveland, Ohio (in thousands)	505	501	476	449	442	438	434	431	396

Let x be the number of years since 1990 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:

$y=-4.88x+517.51$

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

-4.88 = Each year, population decreases by 4.88 thousand/year

517.51 = In 1990, the approximate population was 517.51 thousand.

c) Predict the population of Cleveland in 2020:

$2020-1990=30$

$y=-4.88(30)+517.51=371.11$ thousand

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

$250=-4.88x+517.51 \Rightarrow x=54.82$

$+1990$

During 2044

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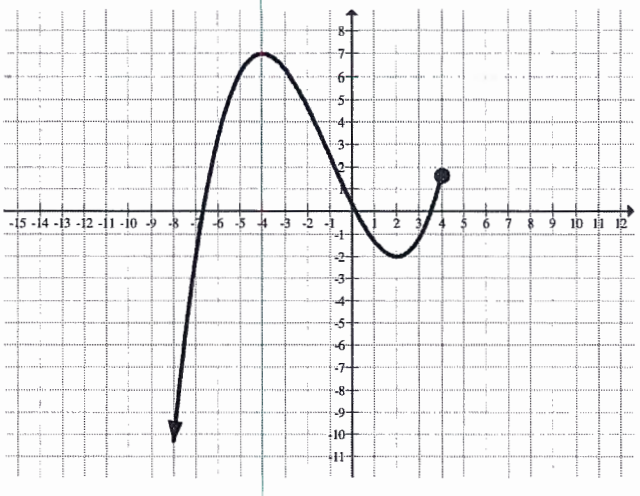
7) (2 points each) For the given graph, find the following. Write parts $a - d$ in interval notation. For parts c and d, write in terms of x. For parts e and f, write answer as an ordered pair.

a) The Domain

$(-\infty, 4]$

b) The Range

$(-\infty, 7]$



c) Increases

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

d) Decreases

$(-4,2)$

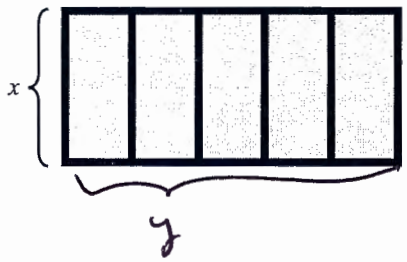
e) Relative Maximum(s)

$(-4,7)$

f) Relative Minimum(s)

$(2,-2)$

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 400 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.



$6x + 2y = 400 \Rightarrow y = 200 - 3x$

$A = xy = x(200 - 3x)$

$A(x) = 200x - 3x^2$

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: $5x - 7 \geq 0$

$x \geq 7/5$

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 $H(x) = \frac{4}{7x^2 - 9} + 7$:

Many Answers $f(x) = \frac{4}{x} + 7 \quad g(x) = 7x^2 - 9$

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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:

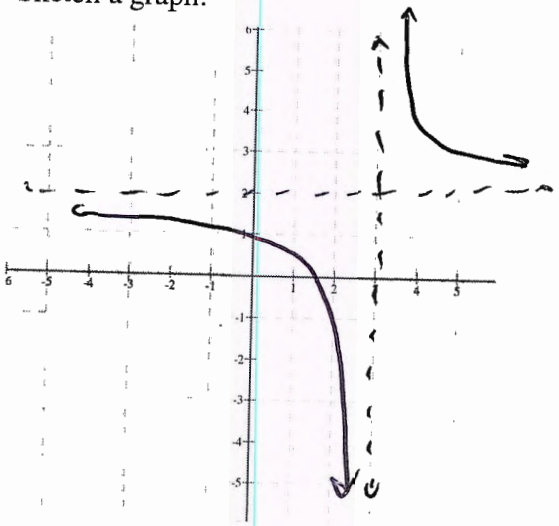
$$f(-x) = \frac{|-x|-2}{(-x)^2} = \boxed{\frac{|x|-2}{x^2}} \quad \text{Even}$$

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 $f(x)=\sqrt{x}$, 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) (8,3) (-9,3) (9,7)

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

J Constant

B Linear

K Identity

C Cube

H Square

G Square root

A Cube root

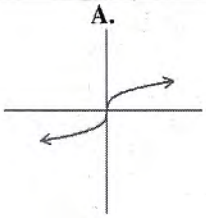
E Greatest-integer

D Reciprocal

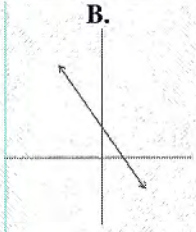
I Absolute value

F Piecewise-defined

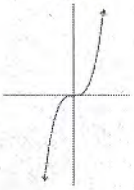
A.



B.



C.



D.
The domain and range do not include zero

E.
Also called the step function

F.
Made up of other functions

G.
The graph is half of a parabola

H.
The graph is called a "parabola"

I.
The graph is V-shaped

J.
The range is one number

K.
Bisects the first and third quadrant

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