1) (2 points each) For the given points $(-3,8)$ and $(2,20)$, find...

a) The distance between them:

$d = \sqrt{(2-(-3))^2 + (20-8)^2}$

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

b) Their midpoint:

$\left(\frac{-3+2}{2}, \frac{8+20}{2}\right) = \left(-\frac{1}{2}, 14\right)$

c) Find the equation of the circle where $(-3,8)$ and $(2,20)$ are endpoints of a diameter of the circle:

$\left(x+\frac{1}{2}\right)^2 + (y-14)^2 = \left(\frac{13}{2}\right)^2 = \frac{169}{4}$

2) (3 points each) Find the domain of the following functions:

a) $f(x) = 5x^3 - 5x^2 + x - 1$

$\mathbb{R}$

b) $g(x) = \dfrac{2x+3}{2x^2-18}$

$2x^2 - 18 = 0$

$x^2 = 9$

$\boxed{x \neq \pm 3}$

c) $h(x) = \dfrac{\sqrt{x+12}}{x^2-9}$ → $x \geq -12$ → $x \neq \pm 3$

$[-12,-3) \cup (-3,3) \cup (3,\infty)$

3) (4 points) While watching *Nailed It!* with his friends, Mike recorded the number of Apple Cider Donut Oreos he had eaten. After the first hour, he had eaten 4 Oreos while after the ninth hour, he had eaten 23 Oreos. Assuming that the relationship between time and the number of Oreos consumed is linear, find an equation a line that models this information. Be sure to define what your variables mean.

Yes, Virginia, these do exist.

$m = \dfrac{23-4}{9-1} = \dfrac{19}{8}$

$y - 4 = \frac{19}{8}(x-1)$

$y - 4 = \frac{19}{8}x - \frac{19}{8}$

$\boxed{y = \frac{19}{8}x + \frac{13}{8}}$

x = # of hours y = # of Oreos

4) (4 points) The population projections for a certain city for selected years is shown the table below. Let the year be the independent variable x and let the projected population (in millions) be the dependent variable y. From 2020 to 2040, find and interpret the average rate of change of y with respect to x.

Year, x	Population (in millions), y
2020	6.5
2040	7.6

$\dfrac{7.6-6.5}{2040-2020} = 0.055$

The population is increasing by ~~0.055 million~~ 55,000 people per year from 2020 to 2040.

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5) (2 points each) During the lockdown, Mike started a new hobby of board games. Below is the number of board games Mike owned during the selected months.

Month, Year	March 2020 3	April 2020 4	August 2020 8	November 2020 11	January 2021 13	April 2021 16	July 2021 19	September 2021 21
Number of Board Games Owned	17	21	44	54	62	74	82	89

Let x be the number of months since December 2019 and let y be the number of board games owned.

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

$y = 4.01x + 7.80$

b) Interpret the slope and y-intercept using the language of the problem. In your interpretation, you can round values to the nearest whole number and use the word "about".

words go here.

c) Assuming this trend continues, predict the number of board games owned in November, 2021:

$x = 23$

$y = 4.01(23) + 7.80 = 100.03$

or about 100 games.

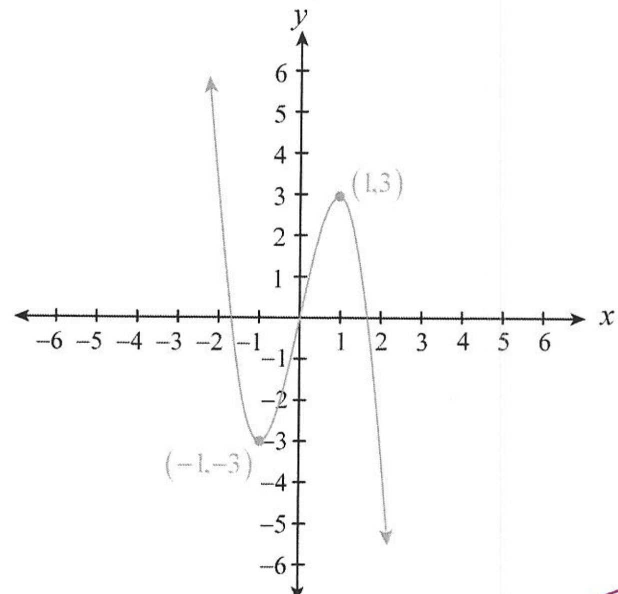
6) (2 points each) For the given graph, find the following. Write parts $a - d$ in interval notation. For parts c and d, write in terms of x. For parts e and f, write answer as an ordered pair.

a) The Domain

$\mathbb{R}$

b) The Range

$\mathbb{R}$



c) Increases

$(-1, 1)$

d) Decreases

$(-\infty, -1) \cup (1, \infty)$

e) Relative Maximum(s)

$(1, 3)$

f) Relative Minimum(s)

$(-1, -3)$

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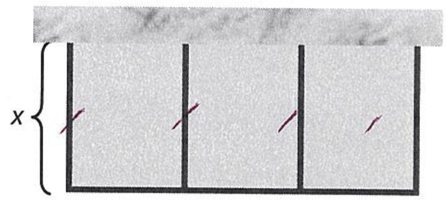
7) (5 points) John Peel, a pineapple herder, wants to build 3 adjacent rectangular pens next to a river for his precious pineapples. He plans to build the enclosure using 100 meters of fencing. The side adjacent to the river will not receive any fencing. Determine the area function in terms of the width of the enclosure, *x*.



$4x + y = 100 \Rightarrow y = 100 - 4x$

$A(x) = xy = x(100 - 4x) = -4x^2 + 100x$

8) (2 points each) For the functions $f(x) = \sqrt{x+2}$ and $g(x) = 4x^2 - 3$, find and simplify…

a) $(f - g)(x)$

$= \sqrt{x+2} - (4x^2 - 3)$

$= \boxed{\sqrt{x+2} - 4x^2 + 3}$

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

$= g(f(x))$

$= g(\sqrt{x+2})$

$= 4(\sqrt{x+2})^2 - 3$

$= 4(x+2) - 3$

$= \boxed{4x + 5}$

c) The domain of $g \circ f$

$D_f: x \geq -2$

$D_g: \mathbb{R}$

$\boxed{D_{g \circ f}: x \geq -2}$

9) (3 points) Find two functions *f* and *g* such that $H = f \circ g$ where $H(x) = 3(x+4)^3 + 1$:

multiple answers:

$f(x) = 3x^3 + 1$

$g(x) = x + 4$

10) (6 points) For the function $f(x) = -2x^2 - 6x + 5$, find and simplify $\dfrac{f(x+h) - f(x)}{h}$:

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

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

$= \dfrac{h(-4x - 2h - 6)}{h} = \boxed{-4x - 2h - 6}$

11) (4 points) Determine if the function $f(x) = \dfrac{4x^3 - 4x^5}{x^2}$ is even, odd, or neither algebraically:

$f(-x) = \dfrac{4(-x)^3 - 4(-x)^5}{(-x)^2} = \dfrac{-4x^3 + 4x^5}{x^2} = -f(x)$

$\boxed{f(x) \text{ is odd}}$

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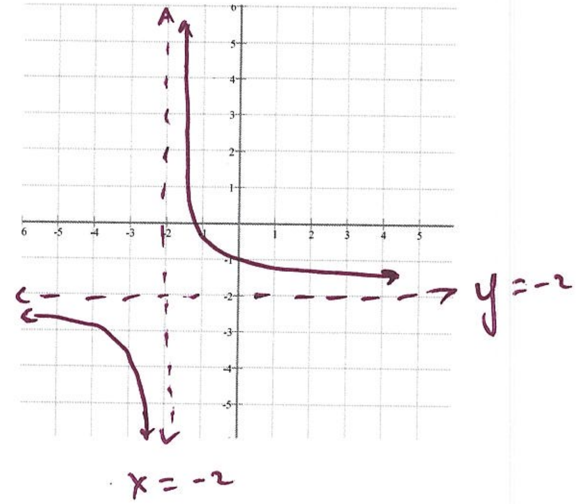
12) (3 points each) For the function $f(x)=\frac{1}{x+2}-2\ldots$ 2

a) List the steps needed to sketch a graph: 1

1) Left 2

2) Down 2

b) Sketch a graph. Be sure to label the asymptotes.



13) (2 points each) Given the point $(-6,4)$ on the graph of $y=f(x)$, find the **exact value** of the coordinates of the point under the transformation below:

a) $y=f(x+6)$ $(-12,4)$

b) $y=f(x)-4$ $(-6,0)$

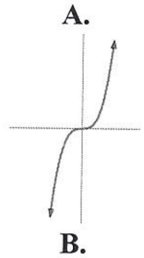
c) $y=-f(x)+6$ $(-6,2)$

d) $y=4f(x-2)+1$ $(-4,17)$

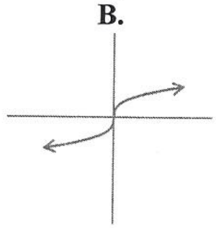
14) (1 point each) Match the following functions with the best description or picture:

H Constant	C Linear	G Identity
A Cube	E Square	F Square root
B Cube root	D Reciprocal	I Absolute value

A.



B.



C. The graph is a non-vertical line

D. The graph has a horizontal and vertical asymptote

E. The graph is U-shaped

F. The domain and range only include non-negative real numbers

G. The graph is a line with a slope of one that passes through the origin

H. The domain is all reals but the range is only one number

I. The graph is V-shaped

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