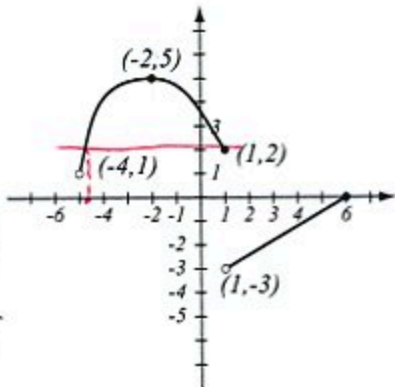


1. (8pts) Use the graph of the function f at right to answer the following questions.

- a) Find: $f(-2) = 5$ $f(1) = 2$
 b) What is the domain of f ? $[-5, 6]$
 c) What is the range of f ? $[-3, 0] \cup [1, 5]$
 d) What are the solutions of the equation $f(x) = 2$? $x = 1, -4.75$



2. (5pts) Write the equation of a linear function f for which $f(-1) = 4$ and $f(3) = -2$.

Need line through $(-1, 4)$ and $(3, -2)$

$$m = \frac{-2-4}{3-(-1)} = \frac{-6}{4} = -\frac{3}{2}$$

$$y - 4 = -\frac{3}{2}(x - (-1))$$

$$y = -\frac{3}{2}x - \frac{3}{2} + 4$$

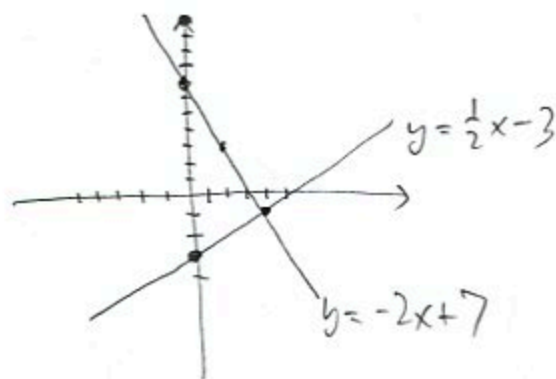
$$y = -\frac{3}{2}x + \frac{5}{2}$$

3. (10pts) Find the equation of the line (in form $y = mx + b$) that passes through point $(2, 3)$ and is perpendicular to the line $x - 2y = 6$. Draw both lines.

$x - 2y = 6$
 $-2y = -x + 6 \quad | \div -2$
 $y = \frac{1}{2}x - 3$ slope is $\frac{1}{2}$

Slope of perp. line is $-\frac{1}{\frac{1}{2}} = -2$

Perp. line:
 $y - 3 = -2(x - 2)$
 $y - 3 = -2x + 4$
 $y = -2x + 7$



4. (9pts) Find the domains of the functions below and write them using interval notation.

$$f(x) = \frac{2}{x^2 + 3x - 10}$$

Can't have $x^2 + 3x - 10 = 0$
 $(x+5)(x-2) = 0$
 $x = -5, 2$

~~numerator~~
 $(-\infty, -5) \cup (-5, 2) \cup (2, \infty)$

$$g(x) = \frac{\sqrt{10-2x}}{x-7}$$

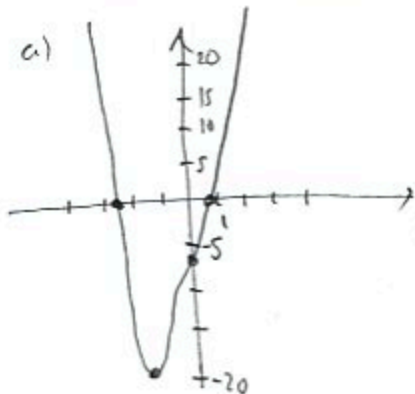
Can't have $x = 7$
 Must have $10 - 2x \geq 0$
 $2x \leq 10$
 $x \leq 5$

~~numerator~~
 $(-\infty, 5]$

5. (19pts) The function $f(x) = x^4 - 2x^2 + 9x - 7$ is given. Solve with accuracy 6 decimal points.

- Use your calculator to accurately draw its graph on paper. Indicate units on the axes.
- Find all the x - and y -intercepts.
- Find the local maxima and minima for this function.
- State the intervals where the function is increasing and where it is decreasing.
- State the domain and range.

b) y -int: $f(0) = -7$
 x -int: $-2.564113, 0.883543$



c) $f(-1.562153) = -19.98485$ is a local min.
 no local max

d) Decreasing on $(-\infty, -1.562153)$
 increasing on $(-1.562153, \infty)$

e) Domain = \mathbb{R}
 Range = $[-19.98485, \infty)$

6. (9pts) Let $g(x) = \frac{2x-3}{x^2+2x+1}$. Find the following (simplify where appropriate).

$$g(1) = \frac{2 \cdot 1 - 3}{1^2 + 2 \cdot 1 + 1} = -\frac{1}{4}$$

$$g(-1) = \frac{2 \cdot (-1) - 3}{(-1)^2 + 2 \cdot (-1) + 1} = \frac{-5}{0} \quad \text{not defined}$$

$$g(-x) = \frac{2(-x) - 3}{(-x)^2 + 2(-x) + 1} = \frac{-2x - 3}{x^2 - 2x + 1}$$

$$g(u-3) = \frac{2(u-3) - 3}{(u-3)^2 + 2(u-3) + 1}$$

$$= \frac{2u - 6 - 3}{u^2 - 6u + 9 + 2u - 6 + 1} = \frac{2u - 9}{u^2 - 4u + 4}$$

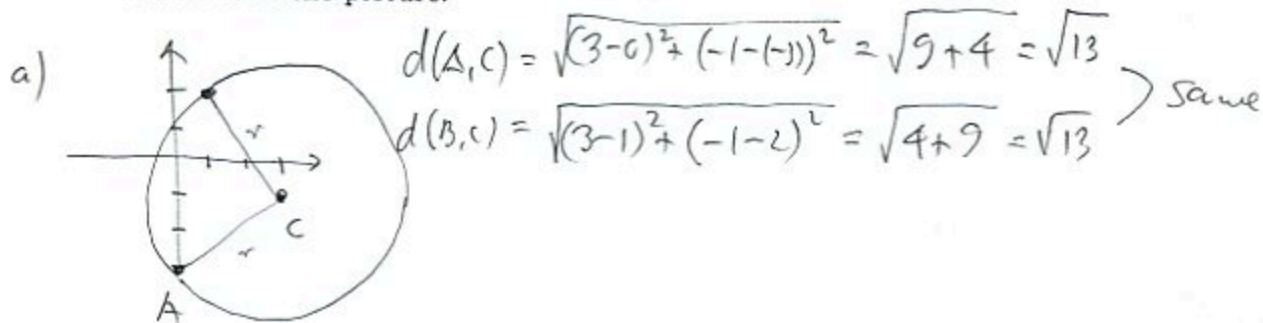
7. (4pts) A household spent 22,110 kWh of electricity in 2012. After installing efficient appliances and lighting, they spent 19,673 kWh in 2016. What is the average rate of change of electricity consumption from 2012 to 2016? What are the units for the average rate of change?

$$\text{avg rate of change} = \frac{19,673 - 22,110}{2016 - 2012} = \frac{-2437}{4} = -609.25 \text{ kWh per year}$$

8. (10pts) Let $A = (0, -3)$, $B = (1, 2)$ and $C = (3, -1)$.

a) Draw the three points and show algebraically that the distance from A to C is the same as the distance from B to C .

b) This means that A and B lie on a circle whose center is C . Write the equation of this circle and draw it in the picture.



b) radius is $\sqrt{13}$, center is $(3, -1)$

$$(x-3)^2 + (y-(-1))^2 = \sqrt{13}^2$$

$$(x-3)^2 + (y+1)^2 = 13$$

9. (12pts) Linda has these options for a data plan for her cell phone:

A) \$18 flat fee for the first two GB, and then \$7 per GB for usage beyond the first two GB.

B) \$8 per GB.

Assuming Linda always uses at least 2 GB of data, for which amount of data is plan B better?

$x =$ no. of GB used

B is better when

$$A(x) = 18 + 7(x-2)$$

$$B(x) \leq A(x)$$

$$8x \leq 18 + 7(x-2)$$

$$B(x) = 8x$$

$$8x \leq 18 + 7x - 14$$

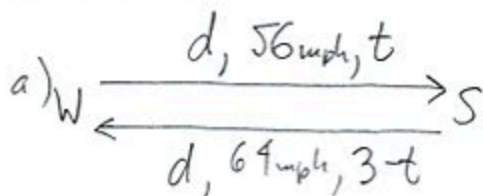
$$x \leq 4$$

For data amounts up to 4 GB, B is better.

10. (14pts) A truck drives a heavy load from a warehouse to a store at 56mph. After unloading, the lighter truck is now able to make the return trip driving at 64mph. Ignoring time spent at the store, the total time spent driving to the store and back was 3 hours.

a) How long did the truck drive to the store? From the store?

b) How far is the store?



b) $56 \cdot 1.6 = 89.6$ miles

same $\left\{ \begin{array}{l} d = 56t \\ d = 64(3-t) \end{array} \right.$

$$56t = 64(3-t)$$

$$56t = 192 - 64t$$

$$120t = 192$$

$$t = \frac{192}{120} = \frac{24}{15} = 1.6 \text{ hrs}$$

(return trip was 1.4 hrs)

Bonus. (10pts) A 4-liter jug contains 1 liter of a 30% solution of muriatic acid. You have pure water and an 8% solution of muriatic acid. How much of each should you add to the jug to end up with a full jug of a 12% solution of muriatic acid? (Hint: think of this problem in the usual way, as mixing three containers to get a fourth with a 12% solution.)

x = amount of water added

$3-x$ = amount of 8% solution added

Use 0.75 liters of water

2.75 liters of 8% solution

$$\left[\begin{array}{c} 1\text{l} \\ 30\% \end{array} \right] + \left[\begin{array}{c} x \\ 0\% \end{array} \right] + \left[\begin{array}{c} 3-x \\ 8\% \end{array} \right] = \left[\begin{array}{c} 4 \\ 12\% \end{array} \right]$$

$$0.3 \cdot 1 + 0 \cdot x + 0.08(3-x) = 0.12 \cdot 4$$

$$0.3 + 0.24 - 0.08x = 0.48 \quad | -0.54$$

$$-0.08x = -0.06$$

$$x = \frac{-0.06}{-0.08} = \frac{6}{8} = \frac{3}{4} = 0.75 \text{ l}$$