Homework #1

Due Monday (February 3rd)

(1) $P(t)$ million people gives the population of the world, t centuries since 1000 AD, $0 \le t \le 10$.

(1.a) (3 points) Complete the following table

Output Variable:	
Input Variable:	
Input Unit:	
Output Unit:	
Input Description:	
Output Description:	
Input Range (or Domain):	
Slope Unit:	

(1.b) (2 points) Write the following statement in function notation: In 1500 AD, the world population was $500,000,000$ people.[1]

(1.c) (3 points) Write your answer you found in part b as an ordered pair and then give a sentence of interpretation of this ordered pair.

(2) $h(x) = -2.1x + 10.2$ hours is the time it takes to clean a house where x is the number of people working, $0 \le x \le 3$.

(2.a) (3 points) Complete the following table

Output Variable:	
Input Variable:	
Input Unit:	
Output Unit:	
Input Description:	
Output Description:	
Input Range (or Domain):	
Slope Units:	

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[1]Keep in mind that $P(t)$ is just a model. In fact, we don't know the exact populatiion of the world in 1500 AD. All we really know is that it was between 425 million people and 540 million people.

(2.b) (1 point) What type of representation does this function have? (Verbal, Algebraic, Numberical, Graphical)

(2.c) (2 points) How many hours did it take to clean a house when 4 people were cleaning it? Is this interpolation or extrapolation?

(2.d) (3 points) Write a sentence of interpretation for $h(0) = 10.2$.[2]

(2.e) (3 points) Write a sentence of interpretation for the slope of this function between the inputs $x = 0$ and $x = 3$.

(3) Let $f(x)$ be the function whose graph is given by
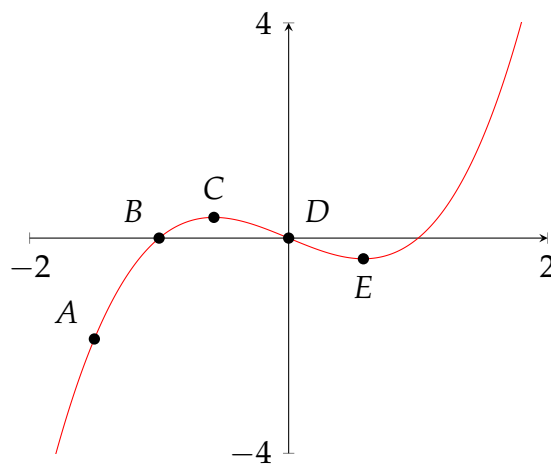
(3.a) (1 point) What kind of a function is $f(x)$? (Linear, Quadratic, Cubic, Exponential, Logarithmic, Logistic)
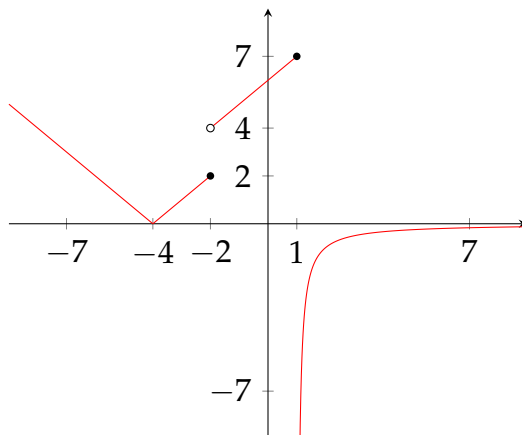
(3.b) (1 point) Which point(s) corresponds to a relative max?

(3.c) (1 point) Which point(s) corresponds to a relative min?

(3.d) (1 point) Which point(s) is an inflection point?

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[2]In other words, write a sentence of the ordered pair $(0, 8.3)$.

(4) Let $g(x)$ be the function whose graph is given by

(4.a) (5 points) Complete the following (write DNE for does not exist):

$$\lim_{x \to -4^+} g(x) =$$

$$\lim_{x \to -4^-} g(x) =$$

$$\lim_{x \to -4} g(x) =$$

$$g(-4) =$$

$$\lim_{x \to -2^+} g(x) =$$

$$\lim_{x \to -2^-} g(x) =$$

$$\lim_{x \to -2} g(x) =$$

$$g(-2) =$$

$$\lim_{x \to 1^+} g(x) =$$

$$\lim_{x \to 1^-} g(x) =$$

$$\lim_{x \to 1} g(x) =$$

$$g(1) =$$

$$\lim_{x \to \infty} g(x) =$$

$$\lim_{x \to -\infty} g(x) =$$

(4.b) (3 points) Where is $g(x)$ continuous? Remember to consider *all* points where $g(x)$ is continuous. Use interval notation for your answer.

(4.c) (3 points) Does $g(x)$ have any horizontal asymptotes? If so, then state how many and then write down the equation of the corresponding line.

(4.d) (3 points) Does $g(x)$ have any vertical asymptotes? If so, then state how many and then write down the equation of the corresponding line.

(4.e) (3 points) State the interval(s) on which $g(x)$ is increasing.

(4.f) (3 points) State the interval(s) on which $g(x)$ is decreasing.

(4.g) (3 points) State the interval(s) on which $g(x)$ is concave down.

(5) (5 points) Complete the following table[3]

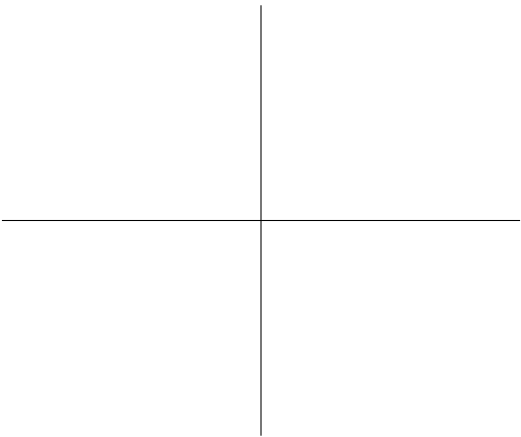| Function	# of Concavities	# of H-Asymptotes	# of V-Asymptotes	# of Inflection Points
Linear				
Quadratic				
Cubic				
Logarithmic				
Exponential				
Logistic				

(6) (3 points) During the qth quarter last year, a bicycle company made $P(q)$ dollars in profit, but their total cost was $C(q)$ thousand dollars. Recall that $q = 3$ refers to the 3rd quarter (July 1st to September 30th). Suppose that $P(3) = 1,000,000$ and $C(3) = 100$. How much revenue (in dollars) did the bicycle company make during the third quarter last year?

(7) Let $f(x)$ be the function whose graph is given below
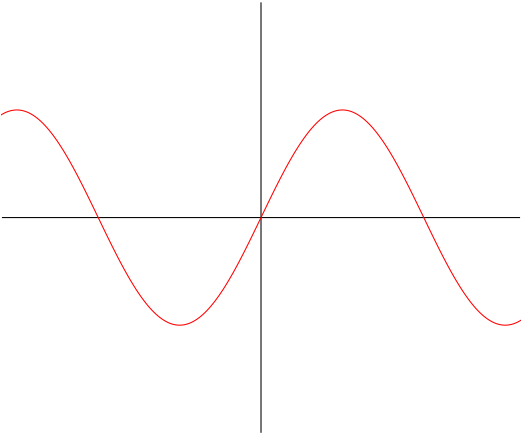
(7.a) (3 points) How many inflection points does this function have?

(7.b) (3 points) Graph the inverse of this function below. Is the inverse a function? Why or why not?
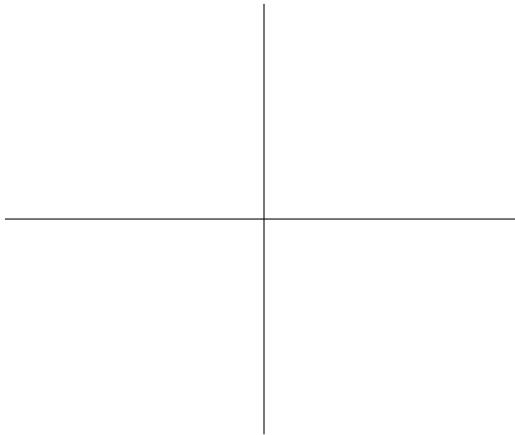
(8) Consider the function $f(x) = \frac{2.53}{1+4.86e^{-0.5x}}$.

(8.a) (1 point) What kind of function is this?

(8.b) (2 points) Find $f(2)$.

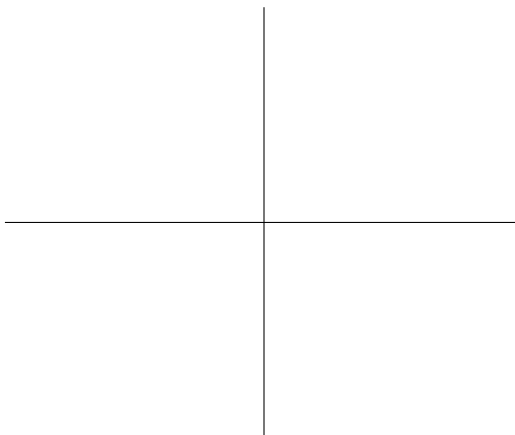(8.c) (3 points) Sketch a graph of this function below

(8.d) (3 points) How many horizontal asymptotes does this function have? If it has any, then write down their equations.

(9) (3 points) $R(x) = 332.10(1.02^x)$ million dollars gives revenue that Company A makes in a given year, where x is the number of years after 2000, $0 \leq x \leq 19$. According to the model, how much will the companies revenue increase per year?

(10) (3 points) Suppose Company B made 30 million dollars in profits during the year 2000 and that their profits are increasing by 1.3% each year between the years 2000 and 2019. Write a completely defined model for their profit.

(11) (2 points) Sketch a graph of the function $-x^2 + 1$ below

Does this function have an inflection point? What about a relative min/max?

(12) (2 points) Sketch a graph of the function $x^2 - 1$ below
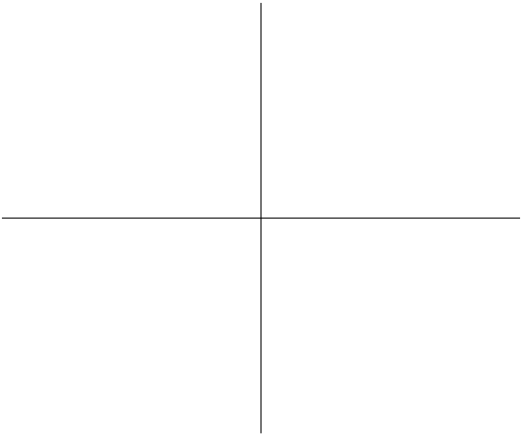
Does this function have an inflection point? What about a relative min/max?

(13) Consider a function $f(x)$.

(13.a) (3 points) What does it mean for $f(x)$ to have a horizontal asymptote?

(13.b) (3 points) What does it mean for $f(x)$ to have a vertical asymptote?

(13.c) (3 points) What does it mean for $f(x)$ to be continuous at $x = c$?

(14) The table shows US consuption of energy from biomass fuels in selected years

year	2002	2004	2006	2008	2010	2012
billion BTUs	2745	2921	3278	3861	4288	4310

(14.a) (3 points) Align the data to the number of years after 2000, and then sketch the a scatter plot for this table below
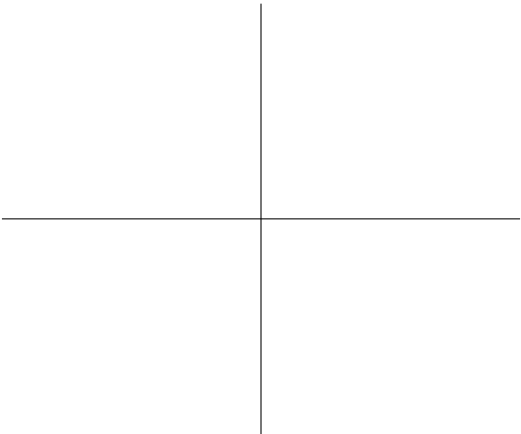
(14.b) (2 points) Based on the scatter plot, which two functions could model the data above?

(14.c) (3 points) Write a completely defined cubic model for the data in the table.