Your Name

Your Signature

Student ID #

Quiz Section

Professor's Name

TA's Name

- This exam is closed book.

- You may use one $8\frac{1}{2} \times 11$ sheet of hand-written notes. Students may not share notes.

- Calculators are allowed. Students may not share calculators.

- In order to receive credit, you must show your work. Do not do computations in your head. Instead, write them out on the exam paper.

- If you use a trial and error (or guess and check) method when an algebraic method is available, you will not receive full credit.

- If you need more room, use the backs of the pages and indicate to the reader that you have done so.

- Raise your hand if you have a question.

Problem	Total Points	Score
1	16	
2	18	
3	12	
4	18	

Problem	Total Points	Score
5	12	
6	10	
7	14	
Total	**100**	

1. (16 points)

   (a) (4 points) Let $f(x) = x^2 + 4$. Compute and simplify

   $$\frac{f(x+h) - f(x)}{h}.$$

   (Simplify your answer far enough so that plugging in $h = 0$ is allowed.)
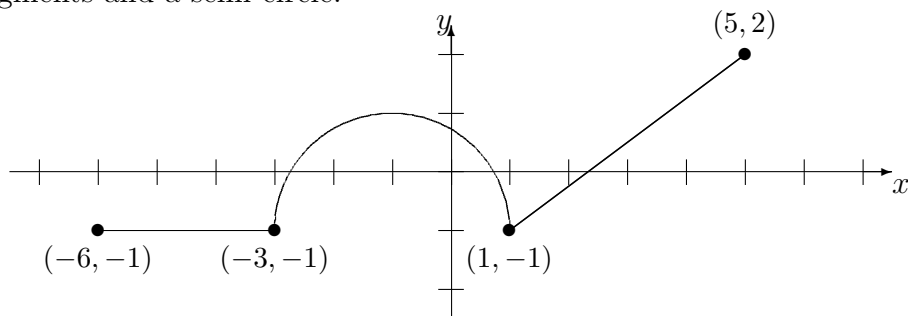
   (b) (4 points) Give the zeros and asymptotes (if any exist) of the following rational function.

   $$y = \frac{2x^2 + 3}{8x^2 + 8x - 160}$$

(c) (4 points) Let $g(x) = \ln\left(\dfrac{x+1}{x}\right)$. Find $g^{-1}(x)$.

(d) (4 points) Solve for a given that $7^{(a^2 - 5a)} = 3$.
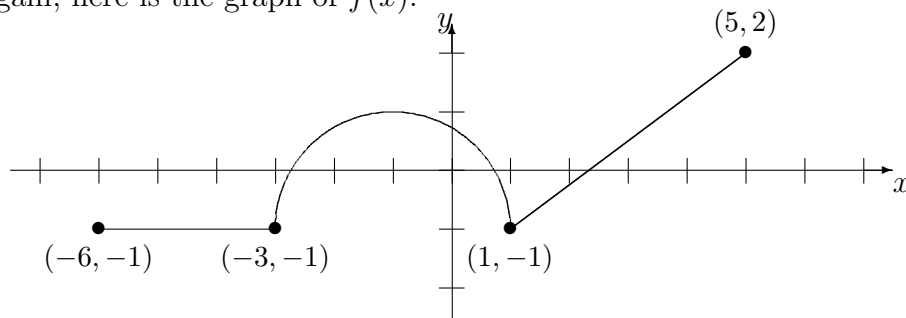
2. (18 points) The following is the graph of a function $f(x)$. The graph is made up of line segments and a semi-circle.

(a) (4 points) What are the domain and range of $f(x)$?

(b) (6 points) Give the multi-part rule that defines $f(x)$.

Again, here is the graph of $f(x)$.

(c) (4 points) Find the x- and y-intercepts of $f(x)$.

(d) (4 points) What are the domain and range of the function

$$g(x) = f\left(\frac{1}{2}(x-1)\right)?$$

3. (12 points) You and some of your pals from Math 120 start a band called the Loga-rhythms, and you decide to market a CD of some of your hit songs, charging $15 per CD. The function $C(x) = 0.03x^2 - 3.6x + 208$ gives the amount it costs to make x CDs.

   (a) (4 points) Your profit will be the amount of money you receive from sales minus the cost required to produce the CDs. What is your profit if you produce and sell 60 CDs?

   (b) (4 points) Give a formula for $P(x)$, your profit if you produce and sell x CDs.

   (c) (4 points) What is your maximum possible profit?

4. (18 points) Dory is playing capture the flag with some of her friends in a wooded area. The opposing team has put their flag 10 feet south of the center of a circular clearing, which has radius 60 feet. Dory has made it to the edge of the clearing, directly west of the center of the circle. She plans to run in a straight line toward the flag, snatch the flag, and continue running in the same direction until she reaches the woods on the other side of the clearing.

   (a) (10 points) Impose a coordinate system with the origin at the center of the clearing. Compute the coordinates of the point where Dory exits the clearing.
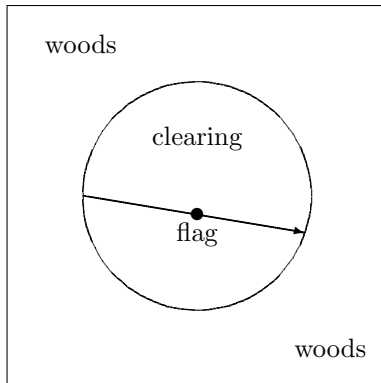
The next two parts require your answer to part (a). If you were unable to complete part (a), then you may make a reasonable guess at the coordinates and use this guess to complete parts (b) and (c). To make it easier on the grader, please put your answer to part (a) OR your guess here:

_____

(b) (4 points) Suppose Dory runs at a constant speed so that she makes it across the clearing in exactly 30 seconds. Give parametric equations for the x- and y-coordinates of Dory's position t seconds after she starts running.

(c) (4 points) Suppose instead that Dory wants to make it across the clearing in 20 seconds or less. How fast does she have to run (in feet per second)?

5. (12 points) Ronny collects coins and breeds bunnies. In 1995 ($t = 0$), Ronny had 220 coins and 6 bunnies. In 2003 ($t = 8$), Ronny has 609 coins and 50 bunnies.

   (a) (4 points) The size of Ronny's coin collection is given by $C(t)$, a linear function of t, time measured in years since 1995. Give a formula for $C(t)$.

   (b) (4 points) The size of Ronny's bunny collection is given by $B(t)$, an exponential function of t, time measured in years since 1995. Give a formula for $B(t)$.

   (c) (4 points) How many coins are in Ronny's collection when Ronny owns 72 bunnies? (Round to the nearest whole coin.)

6. (10 points) The temperature in a museum vault varies according to a sinusoidal function of time. The graph of this function is given below.

temperature in degrees F

$U(9.5, 69)$

$V(??, 62)$

$W(24.5, ??)$

hours since midnight
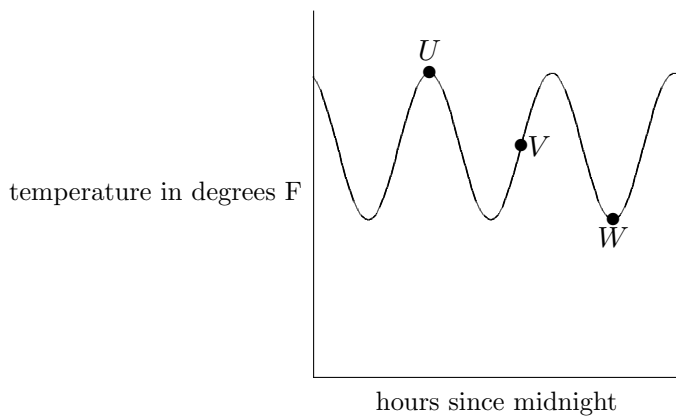
(a) (6 points) Some of the coordinates of the points U, V, and W are given above. The temperature is at its maximum at point U, at its mean at point V, and at its minimum at point W. Give the missing coordinates of points V and W.

ANSWERS: $V($_____,62) $W(24.5,$ _____)

(b) (4 points) The temperature in the vault can be written in the form

$$T(t) = A\sin\left[\frac{2\pi}{B}(t - C)\right] + D.$$

Give the values of A, B, C, and D.

7. (14 points) Rita is riding a ferris wheel which has radius 100 feet and rotates at a constant angular speed counterclockwise. Using a stopwatch, Rita finds it takes 4 seconds to go from the lowest point on the ride to a point which is level with the top of a 44 foot pole. Assume the lowest point of the ride is 3 feet above ground level.
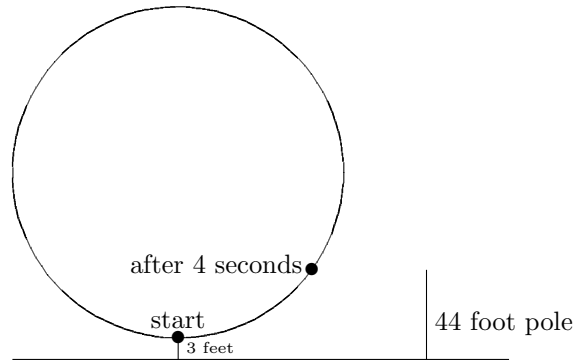
(a) (6 points) What is Rita's angular speed in radians per second?

(b) (4 points) What is Rita's linear speed in feet per second?

(c) (4 points) Placing the center of a coordinate system at the base of the ferris wheel, find parametric equations $x(t)$ and $y(t)$ giving Rita's x- and y-coordinates in terms of time. Assume $t = 0$ when Rita is at the lowest point on the ride.