

Name \_\_\_\_\_ Student Number \_\_\_\_\_

Please check one of the boxes below:

- YES** – please post my grades on the web (using my student ID number)
- NO** – please do not post my grades on the web

- You have 50 minutes for the exam.
- The exam is closed book. You are allowed a 5x7 card of notes.
- You are not allowed to share notes or calculators.
- You must show all your work. You may not receive credit for correct answers with no work shown.
- Place a box around your final answer to every question.
- If you need more room use the backs of pages and indicate to the reader that you have done so.
- Raise your hand if you have a question.
- Each problem is worth 15 points.
- Each part of each problem is worth 5 points.

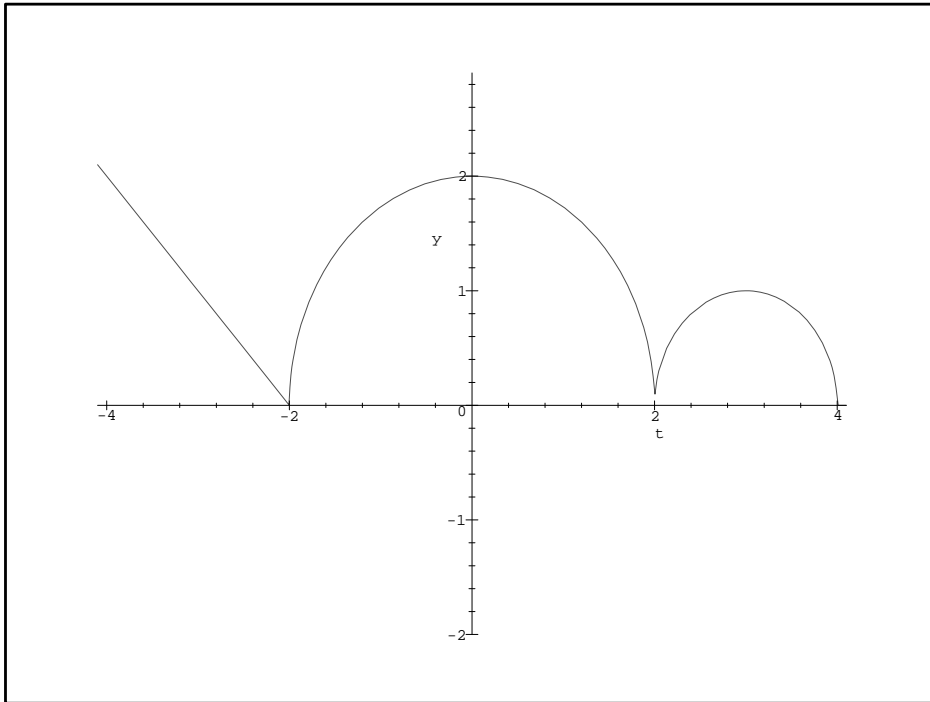
Problem	Total Points	Score
1	15	
2	15	
3	15	
4	15	
Total	60	

1. a) Let  $f(x) = \sqrt{7 + 12x - 4x^2}$  and let  $g(x) = \frac{x+3}{2}$ . Compute and simplify  $f(g(x))$ .

b) Find the intersection points of the line  $y = 5x + 1$  with the parabola  $y = 3x^2 - 3x - 2$ .

c) Find the vertex and axis of symmetry of  $y = -3x^2 + 4x - 7$ .

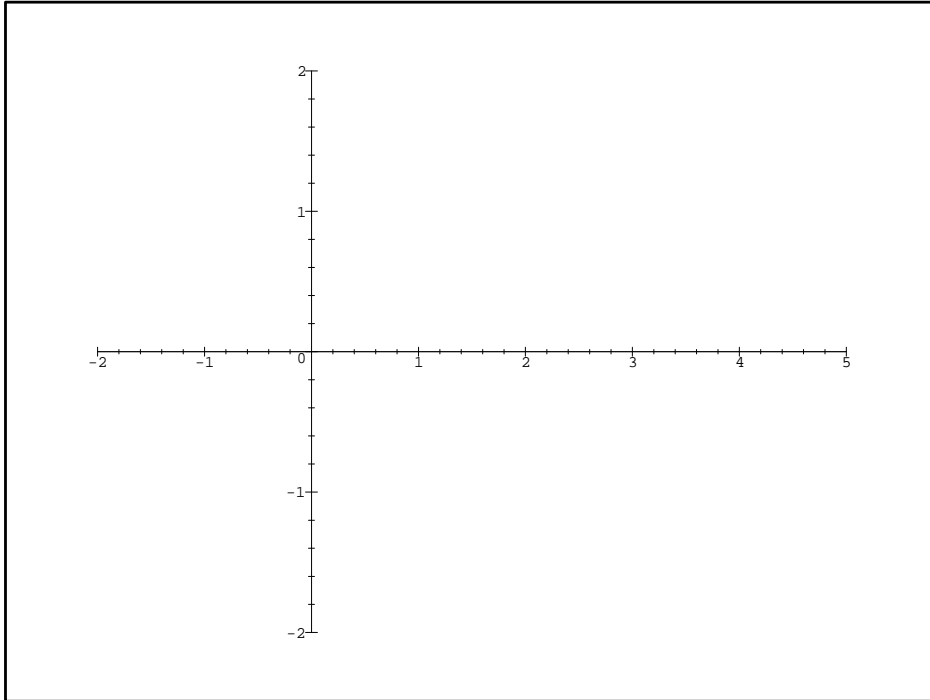
2. This is the graph of the function  $f(x)$  which has domain  $-4 \leq x \leq 4$ . In the graph below, all curves are straight lines or semicircles.



a) Find a multipart formula for the above function.

b) Describe where the function is increasing in terms of intervals on the x-axis.

c) Carefully graph the function  $g(x) = f(2(x - 1)) - 1$  and mark the coordinates of at least three points.



3. Tarzan is in a tree 50 feet above the ground. Set the bottom of the tree to be the origin of a coordinate system. He sees a vine hanging in a parabolic arc which he determines to be given by the equation  $y = 3x^2 - 62x + 350$ .

a) How low does the vine hang?

b) Tarzan leaps from his tree and follows a path in the air given by  $y = -x^2/4 + 2x + 50$ . Tarzan will be able to grab the vine at two different heights. What are those heights?

c) Just in case Tarzan does not grab the vine we want to put a mattress on the jungle floor where he would hit the ground. How far from the tree should we put the mattress?

4. You are racing a go-kart around a circular track that has a radius of 50 feet. In the center of the circle is the announcer's platform. You blow a tire and stop moving at the western edge of the track. Your pit crew immediately leaves the pit to rush to your aid. They race toward you along a straight line path at a speed of 10 ft/sec. The pit is located 60 feet east and 40 feet south of the announcer's platform. Impose a coordinate system with the announcer's platform as the center.

a) How long does it take for the crew to reach your car?

b) When does the crew reach the track?

c) How close does the crew get to the announcer's platform?

## Solutions

1.a)  $f(g(x)) = \sqrt{16 - x^2}$

b)  $(3, 16)$  and  $(-1/3, -2/3) = (-0.33, -0.67)$

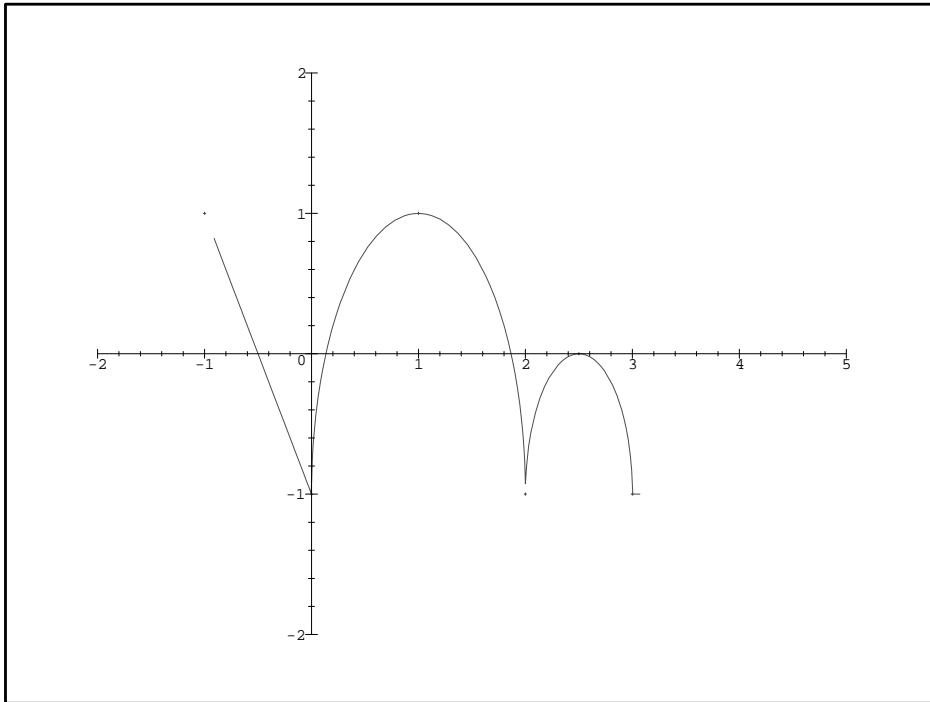
c) vertex  $(2/3, -17/3) = (0.67, -5.67)$ , axis of symmetry  $x = 2/3 = 0.67$ .

2. a)

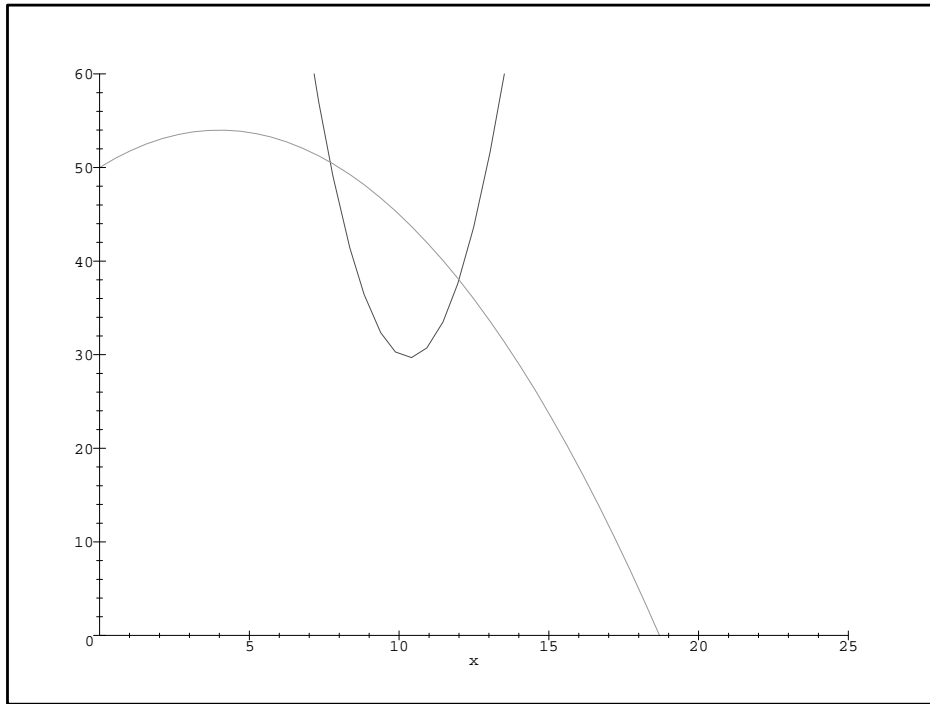
$$f(x) = \begin{cases} -x - 2 & -4 \leq x \leq -2 \\ \sqrt{4 - x^2} & -2 \leq x \leq 2 \\ \sqrt{1 - (x - 3)^2} & 2 \leq x \leq 4 \end{cases}$$

b)  $-2 \leq x \leq 0$  and  $2 \leq x \leq 3$ .

c) Some points that could be labeled are  $(-1, 1)$ ,  $(0, -1)$ ,  $(1, 1)$ ,  $(2, -1)$ ,  $(2.5, 0)$ ,  $(3, -1)$ .



3. Here is a plot of the vine and Tarzan's path in the air.



a) Find the  $y$ -coordinate of the vertex of  $y = 3x^2 - 62x + 350$ , answer is  $y = 89/3 = 29.67$ .  
 b) Simultaneously solve  $3x^2 - 62x + 350$  and  $y = -x^2/4 + 2x + 50$  and give  $y$  solutions,  $y = 8550/169 = 50.6$  or  $y = 38$ . c) Solve  $-x^4/2 + 2x + 50 = 0$  for  $x$ . Pick the positive solution. We get  $x = 4 + 6\sqrt{6} = 18.7$ .

4. Coordinates of pit are  $(60, -40)$ . The car's coordinates are  $(-50, 0)$ .

a) Distance formula  $d = 10\sqrt{137} = 117$ ,  $t = d/s = 11.7$  seconds

b) Track's circle  $x^2 + y^2 = 50$ . Line of motion of crew is  $y = -\frac{4}{11}(x + 50)$ . Simultaneously solve to get  $(0, -50)$  and  $(-4400/137, 5250/137) = (38.3, -32.1)$ . Distance formula  $d = \frac{10}{137}\sqrt{234133} = 35.3$  Time  $t = d/s = 3.53$  seconds.

c) Simultaneously solve  $y = -\frac{4}{11}(x + 50)$  and  $y = \frac{11}{4}x$ . Get  $(-2200/137, -800/137) = (-16.1, -5.84)$ . Distance formula  $d = 200/\sqrt{137} = 17.1$ .