1. Find the absolute maximum and minimum values (if any) for the function

   $f(x) = 2x\sqrt{x+1}$ on the interval [-1, 3]

2. Find the absolute maximum and minimum values (if any) for the function

 $f(x) = \dfrac{x}{x^2 + 2}$ on the interval [-1, 4]

3. The position of an object is given by the function $s(t) = -t^3 + 9t^2 - 24t + 1$

   Describe the motion of this object (give intervals or values where the object is moving right or left, speeding up or slowing down) and find the total distance travelled by the object from $0 \le t \le 5$.

4. Given $f(x) = x^3 - x^2 - 2x$, find all values of x that satisfy the conditions of the mean value theorem on the interval [-1, 1].

5. A helicopter pilot drops a package when the helicopter is at a height of 200 feet and rising at a rate of 20 ft/sec. What is the speed of the package when it hits the ground?

6. Given the graph of $f'(x)$ answer the questions following the graph.

   $f'(x)$

   a) List all points that are relative maximum points of $f(x)$.
       Justify your answer.

   b) List all points that are relative minimum points of $f(x)$.
       Justify your answer.

   A

   C

   B

   D

   E

   c) List all points that are inflection points of $f(x)$.
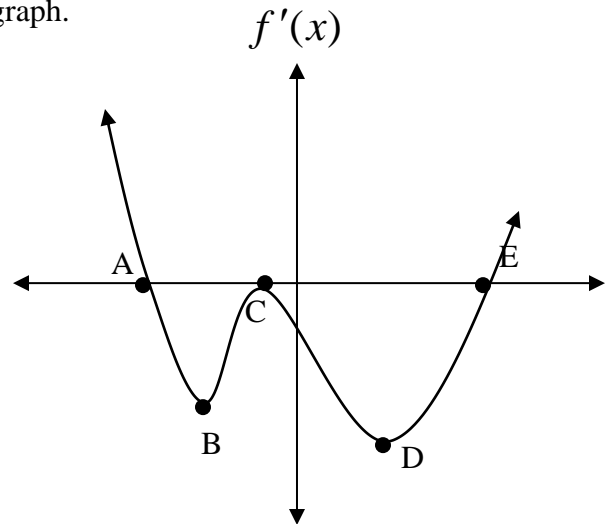
7. A concert promoter knows that 5000 people will attend an event with tickets set at $10. For each dollar less in ticket price, an additional 1000 tickets will be sold. What should the price of a ticket be in order to maximize the total revenue?

8. A physical fitness room consists of a rectangular region with a semicircle on each end. If the perimeter of the room is to be 200 meters, find the dimensions that will make the area of the rectangular region as large as possible.
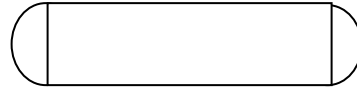
9. $f(x) = x^4 - 6x^2 + 3$ Find each of the following:

   a. Interval(s) where f(x) is increasing.   b. Interval(s) where f(x) is decreasing.

   c. Interval(s) where f(x) is concave up.   d. Interval(s) where f(x) is concave down.

   e. x-coordinates of relative maxima.   f. x-coordinates of relative minima

   g. x-coordinates of any points of inflection.

10. $f(x) = \dfrac{x^2}{x^2 + 2x + 5}$ Find each of the following:
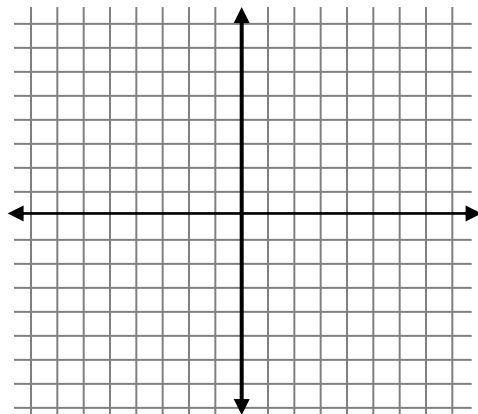
   a.   x-coordinates of all critical points   b. x-coordinates of all stationary points

   c.   x-coordinates of relative maxima.   d.   x-coordinates of relative minima

11. The following is a graph of $y = f'(x)$. Sketch a possible graph of $y = f(x)$
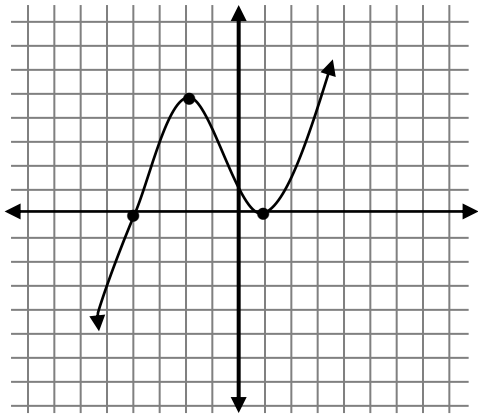
$$y = f'(x)$$ $$y = f(x)$$

12. How many inflection points does the function $f(x) = (x - 2x^3)(\tan x)$ have on the interval (1, 8).

13. For each of the following find $\dfrac{dy}{dx}$. Show all of your work!!

   a. $y = \sqrt{\sin^{-1} x}$ b. $x + e^{xy} = 2$