

For Part A consider the equation $f(x) = x^2 - 3x - 10$

Part A

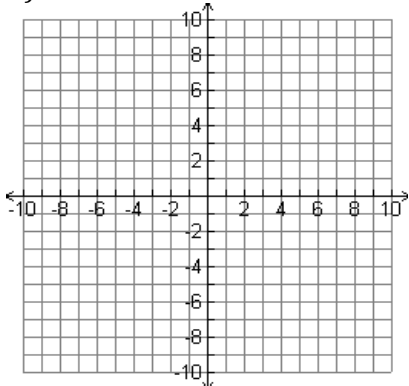
1.) What is the vertex of the function?

2.) On what interval(s) is the function increasing?

3.) On what interval(s) is the function decreasing?

4.) Does the vertex represent a maximum or minimum of the function?

5.) Sketch the function.



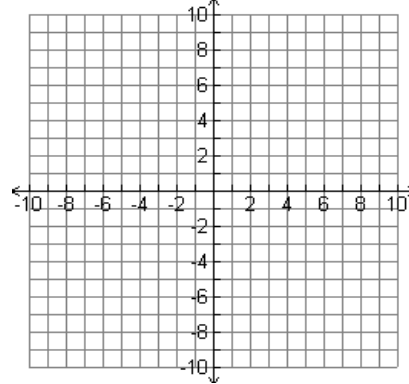
6.) Find the derivative of $f(x)$.

7.) On what interval(s) is $f'(x) > 0$?

8.) On what interval(s) is $f'(x) < 0$?

9.) Where is $f'(x) = 0$?

10.) Sketch a graph of $f'(x)$.



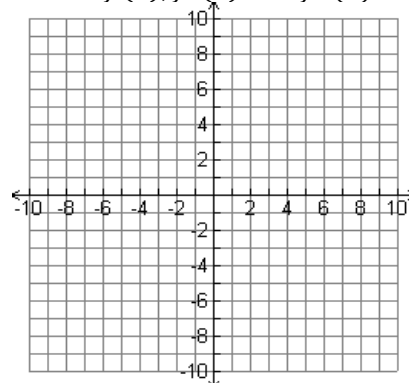
11.) Find the second derivative of $f(x)$.

12.) On what interval(s) is $f''(x) > 0$?

13.) On what interval(s) is $f''(x) < 0$?

14.) What is the value of $f''(x)$ at the vertex found in question 1?

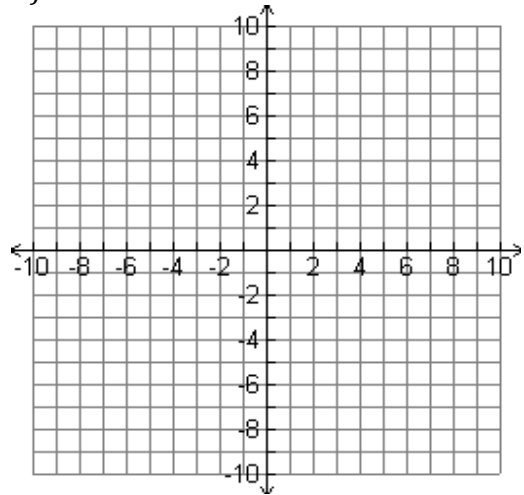
15.) Sketch a graph containing $f(x)$, $f'(x)$ and $f''(x)$.



For Part B consider the equation $f(x) = -3x^2 - 2x + 1$

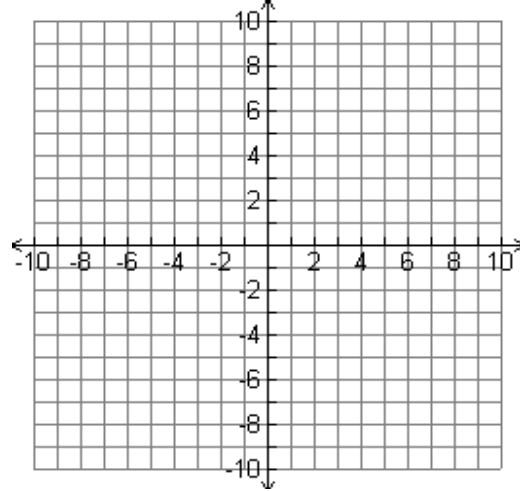
Part B

- 1.) What is the vertex of the function?
- 2.) On what interval(s) is the function increasing?
- 3.) On what interval(s) is the function decreasing?
- 4.) Does the vertex represent a maximum or minimum of the function?
- 5.) Sketch the function.

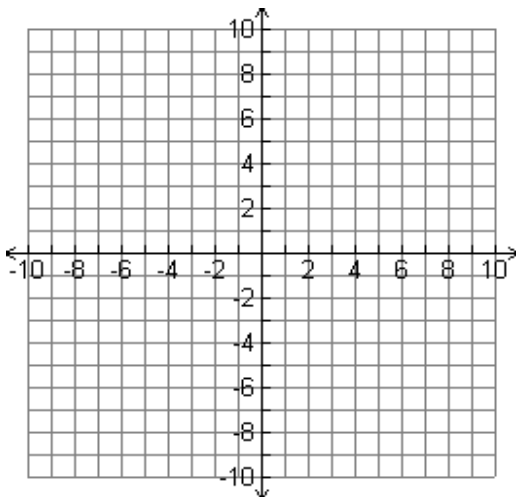


- 6.) Find the derivative of $f(x)$.
- 7.) On what interval(s) is $f'(x) > 0$?
- 8.) On what interval(s) is $f'(x) < 0$?
- 9.) Where is $f'(x) = 0$?

- 10.) Sketch a graph of $f'(x)$.



- 11.) Find the second derivative of $f(x)$.
- 12.) On what interval(s) is $f''(x) > 0$?
- 13.) On what interval(s) is $f''(x) < 0$?
- 14.) What is the value of $f''(x)$ at the vertex found in question 1?
- 15.) Sketch a graph containing $f(x)$, $f'(x)$ and $f''(x)$.



Using the data collected in Parts A and B summarize your results.

Let f be continuous on $[a, b]$ and differentiable on (a, b) .

1. If $f' > 0$ at each point of (a, b) , then f _____ on $[a, b]$.
2. If $f' < 0$ at each point of (a, b) , then f _____ on $[a, b]$.

Let f be continuous on $[a, b]$ and differentiable on (a, b) and there is some value c in (a, b) for which $f'(c) = 0$ then:

1. The point $(c, f(c))$ is a maximum of the function iff $f''(x)$ _____
2. The point $(c, f(c))$ is a minimum of the function iff $f''(x)$ _____

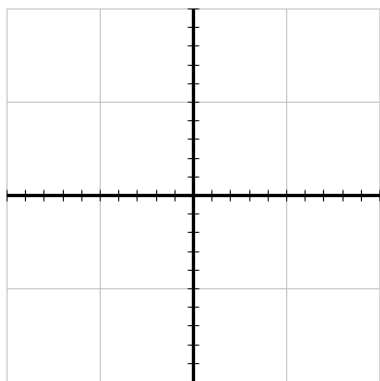
Use these ideas to complete the following problem. No calculator!

Let $f(x) = x^3 + 3x^2 - 45x + 9$

- 1.) Determine the interval(s) where $f(x)$ is increasing or decreasing.

- 2.) Determine where the function has horizontal tangents. What are the maximum(s) and minimum(s) for the function?

- 3.) Sketch the function. What happens when $x = -1$?



Let $f(x) = x^3 - 3x^2 - 24x + 3$

- 1.) Determine the interval(s) where $f(x)$ is increasing or decreasing.

- 2.) Determine where the function has horizontal tangents. What are the maximum(s) and minimum(s) for the function?

- 3.) Sketch the function. What happens when $x = 1$?

