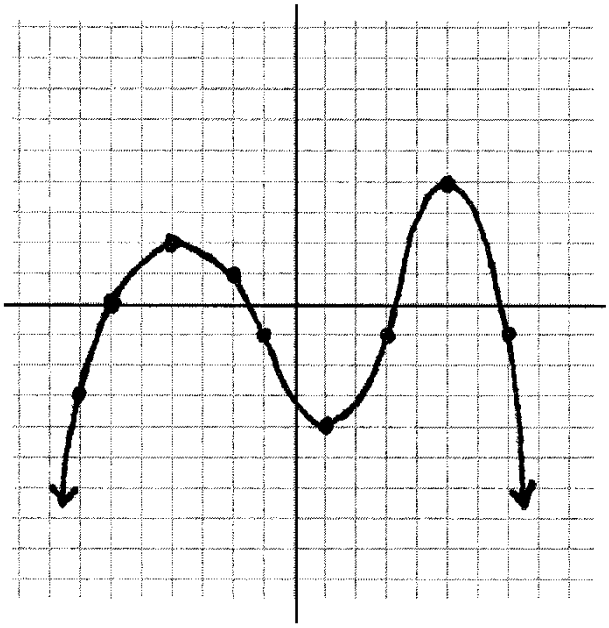
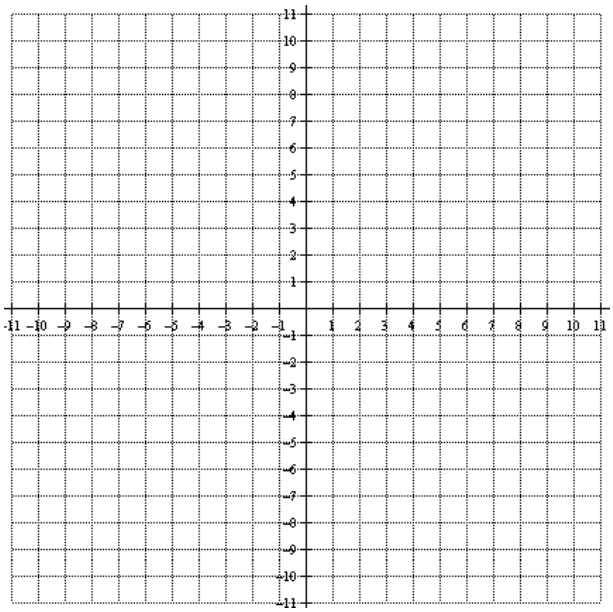
Lesson #4- Connections between $F(x)$ and $F'(x)$ for Polynomial and Trigonometric Functions

$F'(x)$	$F(x)$
Is = 0	
Is > 0	
Is < 0	
Changes from positive to negative	
Changes from negative to positive	

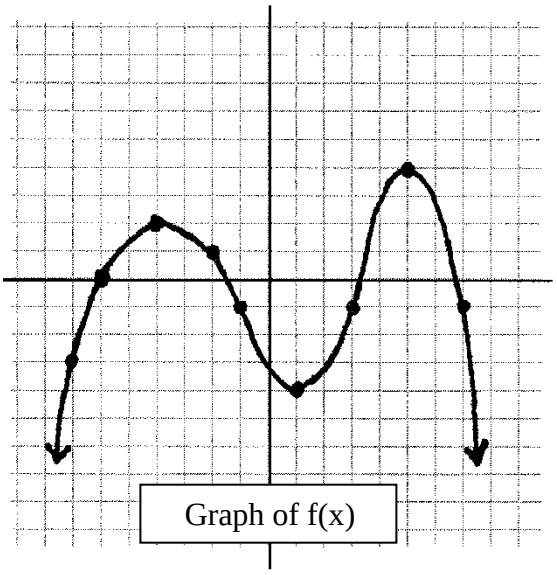


Graph of $f(x)$



Pictured below is the graph of a function $f(x)$. Answer the following questions about the derivative.

1. Approximate the value of $f'(4)$.



2. At what value(s) of x is $f'(x) = 0$. Justify your answer.

3. On what open interval(s) is $f'(x) < 0$? Justify your answer.

4. On what open interval(s) is $f'(x) > 0$? Justify your answer.

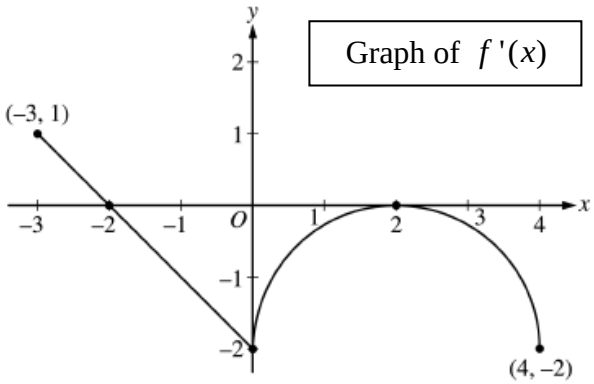
5. At what value(s) of x does the graph of $f'(x)$ go from being below the x – axis to above the x – axis? Justify your answer.

6. At what value(s) of x does the graph of $f'(x)$ go from being above the x – axis to below the x – axis? Justify your answer.

Graphical

Pictured below is the graph of $f'(x)$ on the interval [–3, 4]. Answer the following questions about $f(x)$.

1. On what open interval(s) is the graph of $f(x)$ increasing? Justify your reasoning.



2. On what open interval(s) is the graph of $f(x)$ decreasing? Justify your answer.

3. At what value(s) of x does the graph of $f(x)$ have a horizontal tangent? Justify your answer.

4. At what value(s) of x does the graph of $f(x)$ have a relative maximum? Justify your answer.

5. At what value(s) of x does the graph of $f(x)$ have a relative minimum? Justify your answer.

6. What is the slope of the tangent line to the graph of $f(x)$ at $x = 0$? Justify your reasoning.

7. What is the slope of the normal line to the graph of $f(x)$ at $x = 4$? Justify your reasoning.

Graphical

For each of the given functions, determine the interval(s) on which $f(x)$ is increasing and/or decreasing. Find all coordinates of the relative extrema. Unless otherwise noted, perform the analysis on all values on $(-\infty, \infty)$. Provide justification for your answers.

1. $f(x) = x^3 - 6x + 1$

Analytical

2. $f(x) = 3x^5 - 5x^3$

Analytical

3. $f(\theta) = \theta + 2\sin\theta$ on $(0, 2\pi)$

Analytical

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Lesson #4 Homework

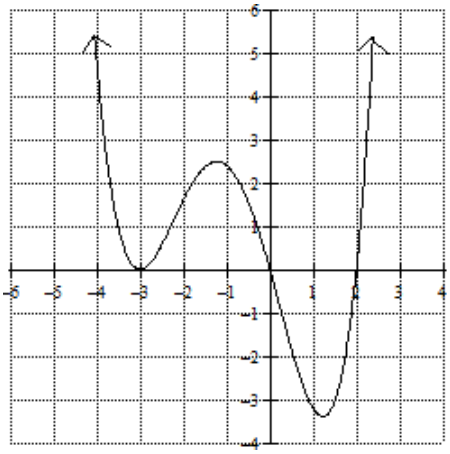
For exercises 1 – 3, determine on what intervals the given function is increasing or decreasing. Also, identify the coordinates of any relative extrema of the function. Show your work and justify your reasoning.

1. $f(x) = 2x^3 + 3x^2 - 12x$

2. $g(x) = x^3 - 6x^2 + 15$

3. $h(x) = (x + 2)^2(x - 1)$

4. Pictured to the right is the graph of $f'(x)$. On what interval(s) is the graph of $f(x)$ increasing or decreasing? Justify your reasoning.



5. Pictured to the right is the graph of $f'(x)$. At what value(s) of x does the graph of $f(x)$ have a relative maximum/minimum? Justify your reasoning.