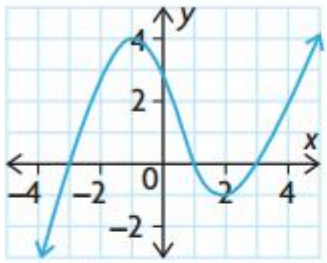
4.1 Intervals of Increase and Decrease

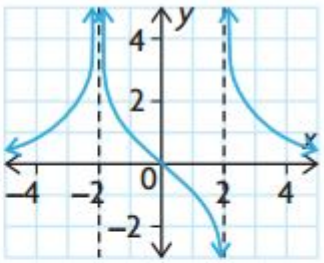
1. Determine the critical values for the functions:
   a. $f(x) = x^4 + 6x^2 - 5$
   b. $g(x) = \sqrt{2x^2 - x}$
   c. $h(x) = \dfrac{5x}{x^2 + 1}$

2. For each of the following graphs, state
   i. the intervals where the function is increasing
   ii. the intervals where the function is decreasing
   iii. the points where the tangent to the function is horizontal

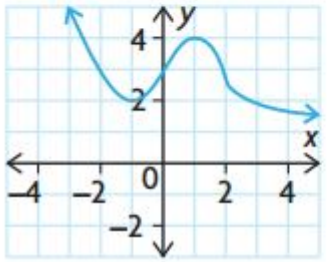
a.



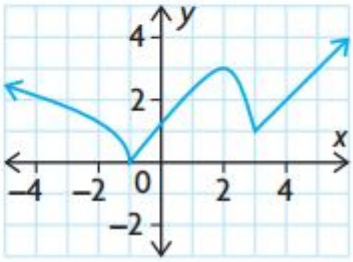
c.



b.



d.



(*Taken from the text: Pg. 169 #3*)

3. Use graphing technology to determine where the given function is increasing and decreasing:
   a. $f(x) = 3x^4 + 4x^3 - 12x^2$
   b. $g(x) = \dfrac{x - 1}{x^2 + 3}$
   c. $h(x) = \dfrac{1}{4}x^4 - 2x^2 + 1$

4. Sketch a graph of a continuous function, $f(x)$, with the following characteristics:
   a. $f'(x) < 0$ when $x < -3$
   b. $f'(x) > 0$ when $-3 < x < 2$, and $x > 5$
   c. $f'(-3) = 0$ and $f'(2) = 0$ and $f'(5) = 0$
   d. $f(-3) = -2$, $f(2) = 3$ and $f(5) = -1$

   Also, state the intervals where $f(x)$ is increasing and decreasing.

   If $f(x)$ is a polynomial function, what would be its minimum order and what would be the sign of its leading coefficient?

5. Suppose $g(x)$ is a differentiable function with derivative $g'(x) = (x+1)(x-2)(x-4)$. Determine the intervals of increase and decrease for $g(x)$.

Answers to selected problems:

1a) $x = 0$ b) $x = \frac{1}{4}$ c) $x = \pm 1$

3a) Increasing on $x \in (-2, 0) \cup (1, \infty)$, decreasing elsewhere.

5) Decreasing on $x \in (-\infty, -1) \cup (2, 4)$, increasing elsewhere.