1. Solve the following inequalities. Write your solution in interval notation and sketch it on the numberline.

(a). $2x^2 + x \geq 3$

(b). $\dfrac{(x-3)^2(x+1)}{x+4} \geq 0$

2. Section 1.1, #10

3. Given $f(x) = \begin{cases} -1, & x \leq -1 \\ x, & -1 < x \leq 2 \\ x^2+1, & x > 2 \end{cases}$

(a). Find the domain and sketch the function.

(b). Find $f(-2)$, $f(2)$, and $f(4)$.

4. Find the domain of $f(x) = \dfrac{1}{\sqrt{x^2+x}}$.

5. Section 1.4 #7

6. Section 1.5 #7, 9, 17

7. Evaluate the following limits, if they exist (clearly indicate $+\infty$ or $-\infty$ in the case of an infinite limit). If the limit does not exist, **explain the reason why**.

(a). $\lim_{x\to 0} \dfrac{x-3}{x(x+4)}$

(b). $\lim_{x\to -4} \dfrac{x^2+2x-8}{x+4}$

(c). $\lim_{x\to 0} \dfrac{\sqrt{3x^2+4}}{x-4}$

(d). $\lim_{x\to 0} \dfrac{x-3}{x^2(x+4)}$

(e). $\lim_{h\to 0} \dfrac{\sqrt{x+h}-\sqrt{x}}{h}$

(f). $\lim_{x\to 1} f(x)$, where $f(x) = \begin{cases} 3, & x \leq 1 \\ 1, & x > 1 \end{cases}$

8. Given that $\lim_{x\to 1} f(x) = 2$, $\lim_{x\to 1} g(x) = 4$, $\lim_{x\to 1} h(x) = 0$, find the following limits if they exist.

(a). $\lim_{x\to 1} f(x) - g(x)$

(b). $\lim_{x\to 1} f(x) \cdot g(x)$

(c). $\lim_{x\to 1} h(x)/g(x)$

(d). $\lim_{x\to 1} g(x)/h(x)$

9. For each of the following functions,
(i) find all of the x-values, if any, where g(x) is discontinuous and
(ii) indicate whether it is a removable, infinite, or jump discontinuity.

(a). $g(x) = \dfrac{x^2-x-6}{x(x^2-9)}$

(b). $f(x) = \begin{cases} x^2-1, & x \leq 1 \\ 1-x & x > 1 \end{cases}$

10. Given the function $f(x) = x^3 - 2x^2 + 8x - 1$, use the Intermediate Value Theorem to show that there is a number c where $0 < c < 2$, such that $f(c) = 6$.

11. Suppose $f(1) = 3, f'(1) = -2, f(5) = 8$, and $f'(5) = 15$. Let P be the point on the graph $y = f(x)$ where $x = 1$. Let Q be the point on the graph of $y = f(x)$ where $x = 5$.

(a). Find the equation of the secant line PQ.

(b). Find the equation of the tangent line to $y = f(x)$ at P.

12. Section 2.1 #49

13. Given $f(x) = x^2 - x$, ***use the limit definition*** $\lim_{x \to a} \frac{f(x) - f(a)}{x - a}$ to find the slope of the tangent line to the curve at $x = 2$. Use your result to write an equation of the tangent line at $x = 2$.

14. Suppose the position of a particle at time t seconds is given by $s(t) = \sqrt{t}$ meters. ***Use the limit definition*** to find the velocity of the particle at time $t = 5$.

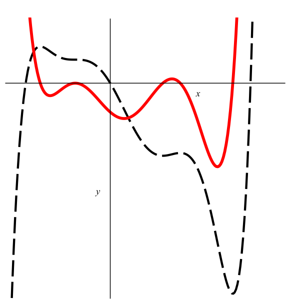
15. ***Use the limit definition*** of the derivative to find $f'(x)$ for the following: [You **must** use the limit definition.]

(a). $f(x) = \frac{1}{x^2}$ ***Simplify your answer.***

(b). $f(x) = 2x^2 + 3x$

16. Find the equation of the tangent line to the curve $y = 2x^2 + 3x$ at the point (1,5).
[Hint: See (b) in previous problem.]

17. Both the function f and its derivative f' are plotted on the same set of axes below. Which curve represents the function and which curve represents the derivative? ***Justify your answer.***



18. Section 2.2 #3, 15, 39.

19. ***Use the limit definition*** $f'(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$ to show that $f(x) = |x - 5|$ is not differentiable at $x = 5$.