1. Differentiate each of the following functions. Assume that a, b and c are non-zero real numbers.

   a) $f(x) = 3x^2 - 5x + 8$

   b) $f(x) = ax^2 + bx + c$

   c) $f(x) = -(x+1)^2$

   d) $f(x) = x^2 - \dfrac{1}{x^2}$

   e) $f(x) = \sqrt{x^7} - \dfrac{1}{x^7} + \log_2 7 - e^7$

   f) $f(x) = \dfrac{(x+5)^3 + (x-5)^3}{2}$

   g) $f(x) = \dfrac{(x+5)^3 - (x-5)^3}{2}$

2. Find a function f such that $f(3) = 10$ and $f'(x) = -5$.

3. Find a function f such that $f(2) = 8$ and $f'(x) = -3x + 1$.

4. Simplify each of the following.

   a) $\log_{16} 8$ b) $\log_8 16$ c) $\log_6 12 + \log_6 3$ d) $\log_2 24 - \log_2 3$

5. Suppose that $x = \log_2 5$. Express each of the following in terms of x.

   a) $\log_2 10$ b) $\log_2 80$ c) $\log_2 50$ d) $\log_5 2$ e) $\log_{20} 10$

6. Find each of the following limits.

   a) $\lim\limits_{x\to\infty} \dfrac{1}{x}$

   b) $\lim\limits_{x\to 0-} \dfrac{1}{x}$

   c) $\lim\limits_{x\to\infty} \dfrac{3}{x^2 - 8}$

   d) $\lim\limits_{x\to -1-} \dfrac{x^2 - 9}{x^2 - 2x - 15}$

   e) $\lim\limits_{x\to -3+} \dfrac{x^2 - 9}{x^2 - 2x - 15}$

   f) $\lim\limits_{x\to 2} \dfrac{1}{x^2 - 9}$

   g) $\lim\limits_{x\to\infty} \left(1 - \dfrac{2}{x}\right)$

   h) $\lim\limits_{x\to\infty} \dfrac{1}{x^2 - 9}$

   i) $\lim\limits_{x\to 3+} \dfrac{1}{x^2 - 9}$

   j) $\lim\limits_{x\to 3-} \dfrac{1}{x^2 - 9}$

   k) $\lim\limits_{x\to 4} \dfrac{x+3}{x^2 - 9}$

   l) $\lim\limits_{x\to -\infty} \dfrac{x+3}{x^2 - 9}$

   m) $\lim\limits_{x\to 3+} \dfrac{x+3}{x^2 - 9}$

   n) $\lim\limits_{x\to 3-} \dfrac{x+3}{x^2 - 9}$

   o) $\lim\limits_{x\to 3} \dfrac{x+3}{x^2 - 9}$

   p) $\lim\limits_{x\to\infty} \left(\dfrac{1}{3}\right)^x$

   q) $\lim\limits_{x\to 3} \dfrac{x^2 - 4}{x - 2}$

   r) $\lim\limits_{x\to -\infty} \dfrac{x^2 - 4}{x - 2}$

   s) $\lim\limits_{x\to 2} \dfrac{x^2 - 4}{x - 2}$

7. Graph each of the following functions.

   a) $f(x) = -5(x+1)x^2(x-2)^3$

   b) $f(x) = -(x+6)(x+5)(x+3)(x+1)^2(x-3)^2(x-6)(x-7)$

   c) $f(x) = (x+1)(4-x)^2(x-2)x^3(6-3x)(-x+1)$

   d) $f(x) = (3x+24)(x+5)(x+8)(x+1)(5-x)^2(7-x)$

8. Solve each of the following inequalities.

   a) $x^2 - 6x + 16 \geq 0$ b) $(x+7)(x-3) \leq 0$ c) $\dfrac{x-3}{x+7} \leq 0$ d) $\dfrac{x-3}{x+7} \geq 2$

9. Prove that the inverse of a linear function is also linear and the two slopes are reciporcals of each other.

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