1. Differentiate each of the following functions using the definition of the derivative being the limit of the differential quotient.

   a) $f(x) = \sqrt{2x-1}$ b) $f(x) = \dfrac{1}{x^2-1}$ c) $f(x) = \sqrt{1-x^2}$

   Skip c) if you already did this as extra credit.

2. Differentiate each of the following.

   a) $f(x) = -4x^3 + x^2 - 6x + 21$

   b) $f(x) = \sqrt[3]{x}$

   c) $f(x) = x^{10} - \sqrt[7]{x^4} - 3\pi$

   d) $f(x) = x^5 - x^2 - \dfrac{1}{x^2} + \dfrac{1}{x^5}$

   e) $f(x) = \sqrt[3]{x^5} - x + \dfrac{1}{e^3}$

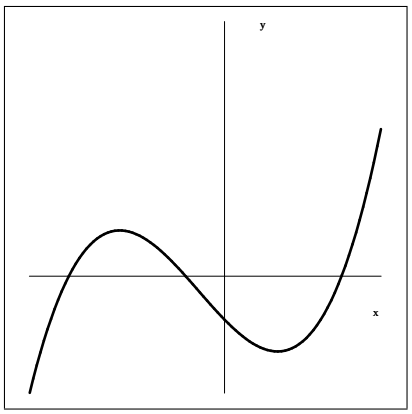
3. Write an equation for the tangent line drawn to the graph of $f(x) = 5x^3 - 3x^2 - 10x + 20$ at $x = -2$.

4. Find all values of x for which the tangent line drawn to the graph of $f(x) = x^3 + 6x^2 - 9x$ has a slope of 6.

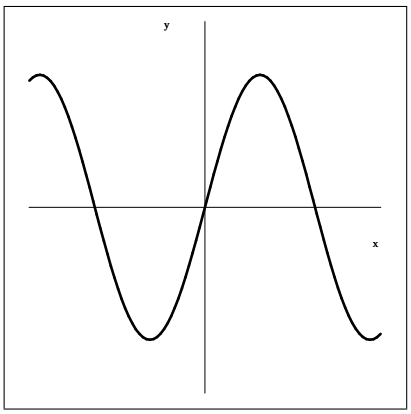
5. Find all values of x for which the tangent line drawn to the graph of $f(x) = \sqrt{x}$ has a slope of $\dfrac{1}{4}$.

6. The picture below depicts the graph of a function $f(x)$. Sketch the graph of the derivative $f'(x)$ in the same coordinate system.

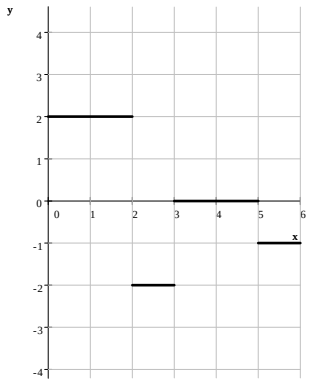
a)



b)



7. The picture below depicts the graph of the derivative $f'(x)$ of a function $f(x)$. Sketch a possible graph of the function $f(x)$ in the same coordinate system.



8. Recall that $\lim_{x\to 0} \dfrac{\sin x}{x} = 1$. Compute each of the following limits.

   a) $\lim_{x\to 0} \dfrac{\tan x}{x}$ b) $\lim_{x\to 0} \dfrac{\sin 7x}{x}$ c) $\lim_{x\to 0} \dfrac{\cos x - 1}{x}$

9. a) Find the perimeter of a 15−sided polygon written into a circle with radius 10 m.
   b) Find the perimeter of an n−sided polygon written into a circle with radius R.
   c) Find the limit of the perimeter of an n−sided polygon written into a circle with radius R as n approaches infinity.

10. a) Find the area of a 15−sided polygon written into a circle with radius 10 m.
    b) Find the area of an n−sided polygon written into a circle with radius R.
    c) Find the limit of the area of an n−sided polygon written into a circle with radius R as n approaches infinity.

11. Consider $f(x) = \sqrt{x}$.
    a) Compute $f'(x)$.
    b) Determine the domains of f and f'. Can you explain why they are different?
    c) Compute $\lim_{x\to 0^+} f'(x)$. What is the geometric interpretation of this result?