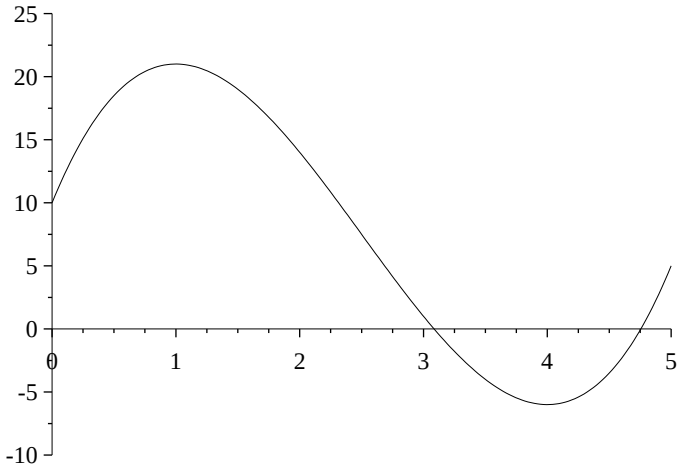
Calculus I
Practice Problems 2

1. Find the derivative: $f(x) = \sqrt{x} + \left(1/\sqrt{x}\right)$

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

3. This graph is that of a function $y = f(x)$. Sketch the graph of its derivative.



4. Sketch the graph of a function with these properties:
a) $f(0) = 2$ and $f(1) = 0$;
b) $f'(x) < 0$ for $0 < x < 2$;
c) $f'(x) > 0$ for $x < 0$ or $x > 2$.

The next two problems are about the motion of an object travelling near the earth's surface in a vertical straight line. if we let $x(t)$ be the height of the object (measured from ground level) at time t,then we have the formula

$$x(t) = -16t^2 + v_0 t + x_0 \ ,$$

where s_0 is the initial height of the object, and v_0 is its initial velocity. Check that

$$v(t) = -32t + v_0 \ , \qquad a(t) = -32 \ .$$

5. A man standing at the edge of the roof of a building 120 feet high throws a ball directly upwards at a velocity of 48 ft/sec. a) How high does the ball go? b) Assuming that it proceeds to fall along the side of the building, how long does it take to hit ground level?

6. Another man standing on ground level throws the ball back to his friend on the roof. At what initial velocity must he throw it in order to reach the roof?

7. Let $y = \dfrac{x}{x^2+1}$. Find the equation of the tangent line to the graph at the point (2,.4).

8. Let C_1 and C_2 be curves given by the equations $C_1 : y = x^3 + x^2$, $C_2 : y = x^2 + x$. For what values of x do these curves have parallel tangent lines?

9. From a point 1000 feet away from the base of a building, the angle of elevation of its roof is 17 degrees. How tall is the building?

10. A marker is rotating counterclockwise around a circle of radius 4 centered at the origin at the rate of 7 revolutions per minute. a) What is its position after 2.3 minutes? b) How soon after 2.3 minutes will it cross the x-axis again?

11. If $\tan\alpha = -\sqrt{3}$, what are the possible values of $\sin\alpha$?

12. Express as a function of $2x$: $\dfrac{\sin x - \cos x}{\sin x + \cos x}$

13. Find $\lim\limits_{x\to 0} \dfrac{\sin(5x)}{\tan(4x)}$.