Some Review Problems
for Exam #2

1. Compute the following derivatives:

   (a) $\dfrac{d}{dt}\left(4t^2 \sin t\right)$

   (b) $\dfrac{d}{du}\left(\dfrac{5\tan u}{u^2 - 3u}\right)$

   (c) $\dfrac{d}{dv}\left(6\cos(7v^2 + 1)\right)$

   (d) $\dfrac{d}{dw}\left(\sqrt{\sin^3 w + \dfrac{8}{w^5}}\right)$

   (e) $\dfrac{d}{dx}\left(\sin 2x\sqrt{x^3 - 2x}\right)$

   (f) $\dfrac{d}{dy}\left(\dfrac{2y + 4}{(y - 1)^5}\right)$

   (g) $\dfrac{d}{dz}\left(\dfrac{\sqrt{z}\cos z}{z^2 + 1}\right)$

2. Find $\dfrac{dy}{dx}$ in the following cases:

   (a) $x^2 y + xy^2 = \tan x$

   (b) $\sin(x + y) = \cos(xy)$

   (c) $\dfrac{y^2}{\sqrt{x}} + y = 5$

3. Find the equation of the tangent line to the following curves at the point $(0, 1)$:

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

   (b) $g(x) = \dfrac{x^2 + 1}{\cos x}$

   (c) $y - \cos(xy) = x$

4. Recall that the volume of a sphere is given by $V = \dfrac{4}{3}\pi r^3$ and its surface area is given by $SA = 4\pi r^2$. Suppose that a spherical snowball is melting and its volume is decreasing at a rate of 2 cubic centimeters per hour.

   (a) How fast is the radius shrinking when the radius is 5 centimeters?

   (b) Using the result from part (a), at what rate is the surface area decreasing when the radius is 5 centimeters?

5. Oliver is hanging Christmas lights on his house. He is on top of a 10-foot ladder which begins to slip. If the base of the ladder is moving away from the house at a rate of 1 foot per second, how fast is Oliver falling downwards when he is 6 feet in the air?

6. Suppose that the height h (in miles above the atmosphere) of a spacecraft is given by the function $h(t) = t^3 - 6t^2 + 9t$ for $0 \le t \le 4$ where t is measured in hours.

   (a) After how many hours does the spacecraft return to 0 miles above the atmosphere?

   (b) On what time interval(s) is the height of spacecraft increasing? On what time interval(s) is the height of the spacecraft decreasing?

   (c) What is the maximum height that the spacecraft attains on the time interval $[0, 4]$?

7. Let $f(x) = (x + 3)^3(x - 2)^4$.

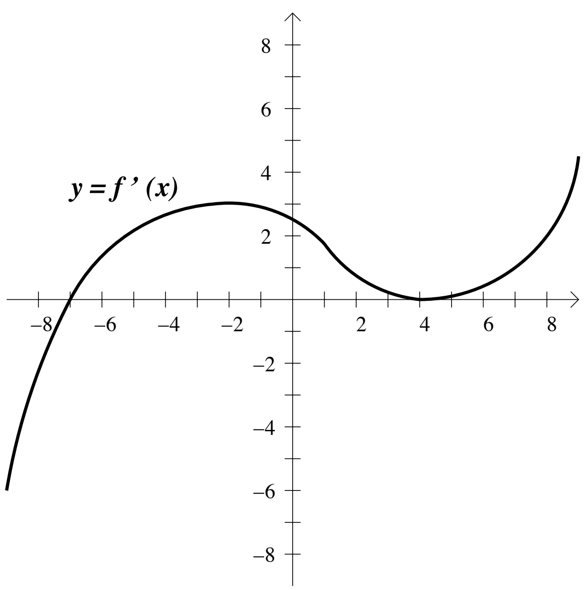
   (a) Find the intervals on which $f(x)$ is increasing and on which $f(x)$ is decreasing.

   (b) Find the local maximums and minimums of $f(x)$.

   (c) Find the intervals on which $f(x)$ is concave up and on which $f(x)$ is concave down.

8. Let $g(x) = 4x^2 - 8x - 1$. Find the global minimum and the global maximum of $g(x)$ on the interval $[0, 3]$.

9. Pictured below is the graph of $f'(x)$, the derivative of the function f. Use the graph of $f'(x)$ to answer the following questions.



   (a) On what interval(s) is $f(x)$ increasing?

   (b) On what interval(s) is $f(x)$ decreasing?

   (c) At what x-value(s) does $f(x)$ achieve a local maximum?

   (d) At what x-value(s) does $f(x)$ achieve a local minimum?