1. (a) Compute $f'(x)$ for $f(x) = \frac{x - 3}{x + 5}$ using the limit definition of the derivative.

(b) Express the limit as a derivative and evaluate: $\lim_{x \to 1} \frac{x^{17} - 1}{x - 1}$.

(c) Express the limit as a derivative and evaluate: $\lim_{h \to 0} \frac{\sqrt{16 + h} - 2}{h}$.

(d) Express the limit as a derivative and evaluate: 
$$\lim_{h \to 0} \frac{2(x + h)^{2} - 3(x + h) + 1 - (2x^{2} - 3x + 1)}{h}.$$ 

2. (a) A ball is dropped from a height of 20 meters, 12 meters away from the top of a 20-meter lamppost. The ball’s shadow, caused by the light at the top of the lamppost, is moving along level ground. How fast is the shadow moving 1 second after the ball is released?

(b) A fish is reeled in at a rate of 1 foot per second from a point 10 feet above the water. At what rate is the angle between the line and the water changing when there is a total of 25 feet of line out?

(c) A trough is 12 feet long and 3 feet across the top. Its ends are isosceles triangles with altitudes of 3 feet. If water is being pumped into the trough at 2 cubic feet per minute, how fast is the water rising when the water is 1 foot deep?

(d) A runner sprints around a circular track of radius 100 m at a constant speed of 7 meters per second. The runner’s friend is standing at a distance 200 m from the center of the track. How fast is the distance between the friends changing when the distance between them is 200 m?
3. (a) Chapter 2 Review Exercises, page 139, # 1
   (b) Chapter 2 Review Exercises, page 139, # 7
   (c) Chapter 2 Review Exercises, page 140, # 50
   (d) Chapter 2 Review Exercises, page 141, # 61

4. (a) Find the equation of the tangent line to the curve \(8(x^2+y^2)^2 = 100(x^2-y^2)\) at (3, 1).
   (b) Show that the hyperbolas \(xy = 1\) and \(x^2 - y^2 = 1\) intersect at right angles.
   (c) Show that the length of the portion of any tangent line to the astroid \(x^{2/3} + y^{2/3} = a^{2/3}\) cut off by the coordinate axes is constant.
   (d) Find \(y''\) if \(x^2 + 4xy + y^2 = 1\).

5. (a) Find the equation of the line tangent to the graph of \(f(x) = x^2+4x-3\) at \(x = -\frac{2}{3}\).
   (b) Find the equation of the line tangent to the graph of \(y = \frac{x^2-1}{x^2+1}\) at \(x = 0\).
   (c) Find the equation of the line tangent to the graph of \(f(x) = 4 \sin^2 x\) at \(x = \pi/6\).
   (d) Find the equation of the line tangent to the graph of \(f(x) = x \sin x\) at \(x = \frac{2\pi}{3}\).