1. 10 pts. each Use differentiation rules to find the derivative of each function.

   (a) $f(x) = (5x^4 + 3x^2 + 1)(x^3 + 7)$

   (b) $g(t) = \dfrac{t^2 - 1}{t^2 + 1}$

   (c) $y = \sin x \cos x$

   (d) $y = \dfrac{2 \cos x}{1 + \sin x}$

2. 5 pts. each The position (in meters) of an object at time t (in seconds) is given by

   $$s(t) = 2t^3 - 21t^2 + 60; \quad 0 \le t \le 6.$$

   (a) Find the object's velocity function. When is the object at rest?

   (b) Find the object's acceleration function. When is the object's acceleration positive, and when is it negative?

3. 10 pts. each Use differentiation rules to find the derivative of each function.

   (a) $f(x) = \sqrt{x^3 + 4}$

   (b) $g(t) = \sin(9 \cos t)$

   (c) $h(z) = \tan\left(\sqrt{\sec z}\right)$

4. 10 pts. Use implicit differentiation to find y', given that

   $$(xy + 1)^3 = x - y^2 + 8$$

5. 10 pts. Find an equation of the tangent line to the curve $3x^3 + 7y^3 = 10y$ at the point $(1, 1)$.

6. 10 pts. A rectangle initially has dimensions 2 cm by 4 cm. All sides begin increasing in length at a rate of 1 cm/s. At what rate is the area of the rectangle increasing after 20 seconds?

7. 10 pts. A 13-ft ladder is leaning against a vertical wall when Vladimir begins pulling the foot of the ladder away from the wall at a rate of 0.5 ft/s. How fast is the top of the ladder sliding down the wall when the foot of the ladder is 5 ft from the wall?