3. Derivative Rules

These Good Problems cover section 2.5 of our book.

1. Compute the derivatives of the functions.

1.) $y = 3x^3 - 9x^2 + \ln(x)$

2.) $f(x) = x^7(x+1)^5$

3.) $f(t) = te^t$

4.) $y = \dfrac{x^5}{\ln x}$

5.) $h(t) = \dfrac{4}{t^5} - 4^t$

6.) $q(s) = \log(s)$

7.) $F(x) = \ln(x^2 e^x)$

2. Compute the derivatives of the functions.

1.) $f(x) = (2x^2 - x)^9$

2.) $V(x) = e^{3x^2+5x}$

3.) $g(x) = \dfrac{1}{(x^2-4)^2}$

3. Find an equation of the tangent line to the curve $y = e^{1-x^2}$ at the point $(1, 1)$.

4. Find all points on the curve $y = x - \ln x$ where the tangent line is horizontal.

A manufacturer has determined that an employee with x days of production experience will be able to produce approximately

$$P(x) = 3 + 15(1 - e^{-0.2x})$$

items per day. Use a graphing utility to graph the function.

5. Approximately how many items will a beginning employee be able to produce each day?

6. How many items will an experienced employee (who has worked at the company for years) be able to produce?

7. What is the marginal production rate of an employee with 5 days experience? What are the units and what does this answer mean?

8. An arrow shot straight up from ground level with an initial velocity of 128 feet per second will be at a height

$$h(t) = -16t^2 + 128t$$

feet after t seconds. Determine *a.*) At what time will the arrow reach its highest point (Hint: the arrow's velocity will be 0 at this point); and b.) How long will the arrow be aloft?

9. Consider a cubic function of the form

$$f(x) = x^3 + Ax^2 + Bx + C.$$

Find conditions on the constants A, B, and C to guarantee that the graph of $y = f(x)$ has two distinct turning points.