Hw 10
\[ y = \sqrt{1 + 2t} \quad (a) \quad \frac{dy}{dt}, \quad (b) \quad \frac{d^2y}{dt^2} \]

Ans. (a) \( \frac{dy}{dt} = \frac{2}{2\sqrt{1 + 2t}} = \frac{1}{\sqrt{1 + 2t}} \)

(b) \( \frac{d^2y}{dt^2} = ((1 + 2t)^{-1/2})' = -\frac{1}{2}(1 + 2t)^{-3/2}(2) = \frac{-1}{(1 + 2t)^{3/2}} \).

Hw 11
A rock is thrown upward. Its height at time \( t \) is \( z = 8t - t^2 \).
What is its acceleration at time \( t \)? Ans. \(-2\)
What is the rock’s maximum height? Ans. 16

Hw 11
The picture shows an object’s velocity \( v \) on the \( y \)-axis at time \( t \).

\begin{figure}
\centering
\includegraphics[width=\textwidth]{velocity_graph.png}
\end{figure}

On what interval(s) of time does the object move upward? Ans. [2, 8]
On what interval(s) of time is the velocity decreasing? Ans. [6, 8]
On what interval(s) of time is it moving at its greatest speed? Ans. [4, 6]
On what interval (of more than one point) of time is the object motionless? Ans. [0, 2]

Hw 12a
\[ y = (2 - \frac{1}{x})^{-2}, \quad \frac{dy}{dx} = ? \]

Ans. \(-2(2 - \frac{1}{x})^{-3}(\frac{1}{x^2}) = \frac{-2x}{(2x-1)^3}\)

Hw 12b
\[ r = -\sqrt{\cos(\theta^2)}, \quad \frac{dr}{d\theta} = ? \]

Ans. \(\frac{-1}{2\sqrt{\cos(\theta^2)}}(-\sin(\theta^2))(2\theta) = \frac{\theta}{\sqrt{\cos(\theta^2)}} \sin(\theta^2)\)

Hw 13
\( x = t^2, \quad y = t^2 \). Find the equation for the line tangent to this curve when \( t = 1 \).

Ans. \( \frac{dx}{dt} = 2t^3, \quad \frac{dy}{dt} = 2t, \quad \frac{dy}{dx} = -t^4 \) when \( t = 1, x = 1, y = 1, \frac{dy}{dx} = -1 \)
\( y - y_0 = m(x - x_0), \quad y - 1 = -(x - 1), \quad y = -x + 1 + 1, \quad y = -x + 2 \)

Hw 14
\( x + xy + y = 0 \) (a) Find \( \frac{dy}{dx} \) (b) Find \( \frac{d^2y}{dx^2} \)

Ans. \( 1 + y + xy' + y' = 0, \quad y' = \frac{y + 1}{x + 1}, \quad y'' = \left( \frac{y + 1}{x + 1} \right)' = \frac{-\frac{y + 1}{x + 1} - (y + 1)}{(x + 1)^2} = \frac{-\frac{y + 1}{x + 1} - y - 1}{(x + 1)^2} = \frac{2y + 2}{(x + 1)^2} \)

Hw 15
A rectangle of varying width $x$ and height $y$ is inscribed in a circle of diameter 2. Write an equation which relates $\frac{dy}{dt}$ and $\frac{dx}{dt}$.

Ans. $x^2 + y^2 = 2^2$, $2x \frac{dx}{dt} + 2y \frac{dy}{dt} = 0$, $x \frac{dx}{dt} = -y \frac{dy}{dt}$.

**Hw 16**

Pedestrian $A$ walks toward an intersection $I$ from the north at 2 meters/second. Pedestrian $B$ walks westward away from the intersection at 1 meter/second. What is the rate of change of the angle $\theta$ between the ray from $B$ to the intersection and the ray from $B$ to $A$ (the angle $\angle BIA$), when $A$ is 10 meters from the intersection and $B$ is 20 meters away? This is homework 16, problem 36(5).

![Diagram of A, B, and I with angle \(\theta\) between BA and BI]

**Want?**

**Given?**

**Eq.?**

**Hw 17**

You must measure the area of a circle to within .1 square foot. How accurate must you measure the radius if your radius estimate is 10 feet?

Ans. $A = \pi r^2$, $dA = \pi 2rd\theta = 2\pi r d\theta$, $dA \leq .1 \Rightarrow 2\pi (10)d\theta \leq .1 \Rightarrow d\theta \leq \frac{.1}{20\pi} = \frac{1}{200\pi}$ feet