1. Find the equations for the following lines and sketch their graphs.

(a) The line with slope 3 and y-intercept 2.
(b) The line with slope 3 passing through the point (2, 1).
(c) The line which contains the points (1, 1) and (3, 2).

Solution:
(a) The line with slope $m$ and y-intercept $b$ is given by

$$y = mx + b.$$ 

So, for $m = 3$, and $b = 2$, the equation of the line is

$$y = 3x + 2.$$ 

(b) By the one-point slope formula, equation of the line with slope $m$ and containing the point $(x_1, y_1)$ is

$$y - y_1 = m(x - x_1).$$ 

Plug in the values $m = 3$ and $x_1 = 2, y_1 = 1$ to obtain the equation of the line

$$y - 1 = 3(x - 2).$$
(c) Slope \( m \) of the line passing through points \((x_1, y_1)\) and \((x_2, y_2)\) is given by \( m = \frac{y_2 - y_1}{x_2 - x_1} \). Plug in the values of the two given points to obtain the slope of the line

\[
m = \frac{2 - 1}{3 - 1} = \frac{1}{2}.
\]

By the one point point slope formula, the line is given as

\[
y - 1 = \frac{1}{2}(x - 1).
\]

2. If \( f(2) = 1 \) and the tangent line to the graph of \( f \) at 2 has \( y \)-intercept 3, what is \( f'(2) \)?

**Solution:** The points \((2, f(2))\) and \((0, 3)\) lie on the tangent line. So, the slope of the line is \( m = \frac{3 - 1}{0 - 2} = -1 \). Since the slope of the tangent line is the derivative, \( f'(2) = -1 \).

3. The height and velocity of a projectile in feet at time \( t \) in seconds is given by

\[
p(t) = -16t^2 + 50t + 8, \quad v(t) = p'(t) = -32t + 50
\]
(a) How high was the projectile when it was fired?
(b) How fast was the projectile fired?
(c) When is the projectile at its highest point?
(d) How high does the projectile go?

Solutions:

(a) \( p(0) = 8 \). So, the projectile was 8 feet height when it was fired.
(b) \( p'(0) = v(0) = 50 \). So it was fired with speed 50 feet per second.
(c) \( p'(t) = v(t) = 0 \) i.e. \(-32t + 50 = 0 \) i.e. \( t = \frac{50}{32} \). Also \( p'(t) > 0 \) for \( t < \frac{50}{32} \) and \( p'(t) < 0 \) for \( t > \frac{50}{32} \). So the projectile goes up until \( t = \frac{50}{32} \) and starts going down after \( t = \frac{50}{32} \). So, it’s at its highest point at \( t = \frac{50}{32} \).
(d) The height \( p(t) \) is maximum when \( t = \frac{50}{32} \). So the maximum height is

\[
p\left(\frac{50}{32}\right) = -16\left(\frac{50}{32}\right)^2 + 50\left(\frac{50}{32}\right) + 8 = \frac{753}{16}.
\]

4. Determine the point of intersection of the two lines determined by \( 2x + 3y = 4 \) and \( 4x + 5y = 7 \).

**Solution:** Multiply the first equation by 2 to obtain \( 4x + 6y = 8 \). Now subtract the other equation for it, and we get \( y = 1 \). Plug in \( y = 1 \) in either of the equations to obtain \( x = 1/2 \). So, the point of intersection is \((1/2, 1)\).