

1. (a) Distance:  $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(1 - (-3))^2 + (3 - 5)^2} = \sqrt{16 + 4} = \sqrt{20} = 2\sqrt{5}$ .

1. (b) Slope:  $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 5}{1 - (-3)} = \frac{-2}{4} = -\frac{1}{2}$ .

Then the equation is:

$$\begin{aligned} y - y_1 &= m(x - x_1) \\ y - 5 &= -\frac{1}{2}(x - (-3)) \\ y &= -\frac{1}{2}x - \frac{3}{2} + 5 \\ y &= -\frac{1}{2}x + 3.5. \end{aligned}$$

2. Using Gaussian-elimination (Gauss-Jordan Elimination can be used also!):

$$\left[ \begin{array}{ccc|c} -1 & 1 & -1 & -14 \\ 2 & -1 & 1 & 21 \\ 3 & 2 & 1 & 19 \end{array} \right] \sim \left[ \begin{array}{ccc|c} -1 & 1 & -1 & -14 \\ 0 & 1 & -1 & -7 \\ 0 & 5 & -2 & -23 \end{array} \right] \sim \left[ \begin{array}{ccc|c} -1 & 1 & -1 & -14 \\ 0 & 1 & -1 & -7 \\ 0 & 0 & 3 & 12 \end{array} \right] \sim \left[ \begin{array}{ccc|c} -1 & 1 & -1 & -14 \\ 0 & 1 & -1 & -7 \\ 0 & 0 & 1 & 4 \end{array} \right]$$

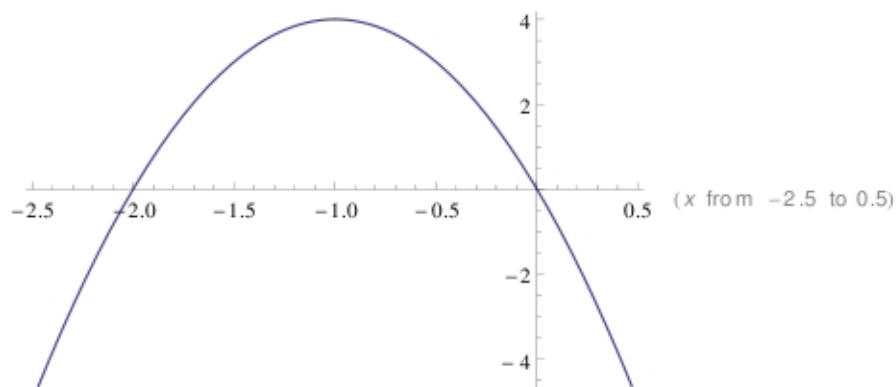
$$\begin{aligned} 1 \cdot z &= 4 \implies z = 4 \\ 1 \cdot y - 1 \cdot z &= -7 \implies y = -3 \\ 1 \cdot x - 1 \cdot y + 1 \cdot z &= 14 \implies x = 7. \end{aligned}$$

3. (a) Parent function:  $f(x) = x^2$ .

Transformations: vert. shift up 4,  $x$ -axis reflection, vert. stretch by a factor of 4, hor. shift left 1.

3. (b) Graph should look like the following, with scale and a few points labeled.

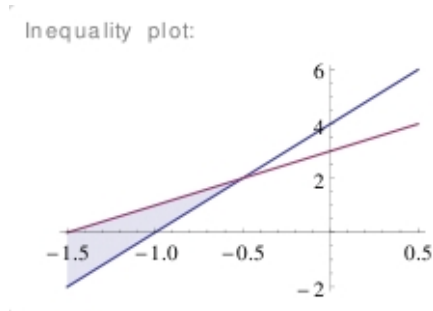
Plots:



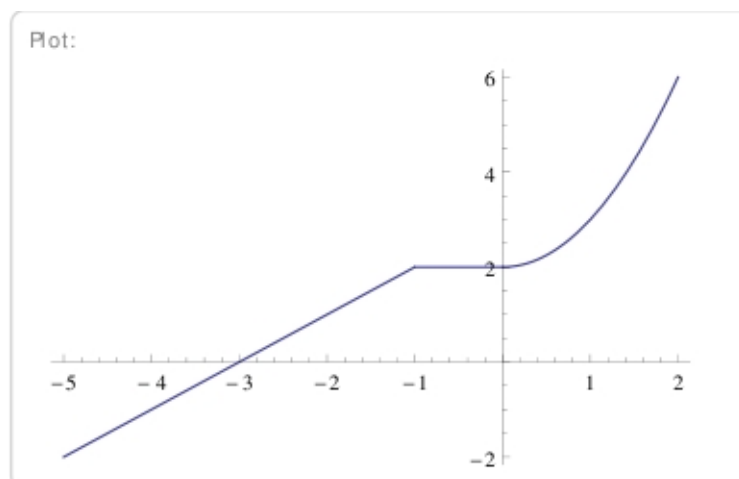
4. (a) Algebraic solution:

$$\begin{aligned}
 y_1 &\leq y_2 \\
 4(x+1) &\leq 2x+3 \\
 4x+4 &< 2x+3 \\
 2x &\leq -1 \\
 x &\leq -1/2.
 \end{aligned}$$

Graph:



5. (a) Graph should look like the following, with scale and at least three points labeled.



5. (b) Domain:  $[-5, 2]$ ; Range:  $[-2, 6]$ .

5. (c) Increasing:  $(-5, -1) \cup (0, 2)$ ; Constant:  $(-1, 0)$ ; Decreasing: never.

6. (a)  $h(x) = (f \circ g)(x) = f(g(x)) = 2(x+5) = 2x+5$ .

6. (b)

$$\begin{aligned}
 h(x) &= 2x+10 \\
 y &= 2x+10 \\
 x &= 2y+10 \\
 2y &= x-10 \\
 y &= \frac{x-10}{2} \\
 h^{-1}(x) &= \frac{1}{2}x-5.
 \end{aligned}$$

**Bonus.**

$$\begin{aligned}\frac{f(x+h) - f(x)}{h} &= \frac{((x+h)^2 - 3(x+h)) - (x^2 - 3x)}{h} \\&= \frac{x^2 - 2xh + h^2 - 3x - 3h - x^2 + 3x}{h} \\&= \frac{h^2 + 2xh - 3h}{h} \\&= h + 2x - 3.\end{aligned}$$