Both of these conditions are true when $x \geq \frac{5}{3}$.

Case 1: Both factors are negative.

$3x - 5 \leq 0$ and $4x + 3 \leq 0$

$x \leq \frac{5}{3}$ and $x \leq -\frac{3}{4}$

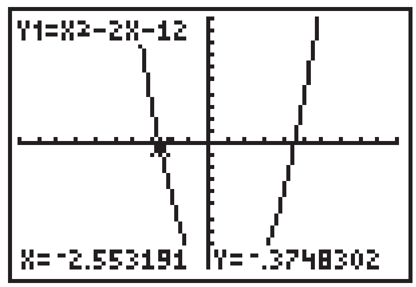
Both of these conditions are true when $x \leq -\frac{3}{4}$.

The solution set is $\{x \mid x \leq -\frac{3}{4} \text{ or } x \geq \frac{5}{3},\ x \in \mathrm{R}\}$.

c) $x^2 - 2x - 12 \leq 0$

Graph the function $y = x^2 - 2x - 12$.

Use the quadratic formula to find the roots.



$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-12)}}{2(1)}$$

$$x = \frac{2 \pm \sqrt{52}}{2}$$

$$x = 1 \pm \sqrt{13}$$

The function is below the x-axis between the two roots.

The solution set is $\{x \mid 1 - \sqrt{13} \leq x \leq 1 + \sqrt{13},\ x \in \mathrm{R}\}$.

d) $x^2 - 6x + 9 > 0$

Use case analysis because the expression is easy to factor.

$(x - 3)(x - 3) > 0$

$(x - 3)^2 > 0$

This condition is true for all real values except $x = 3$.

The solution set is $\{x \mid x \neq 3,\ x \in \mathrm{R}\}$.

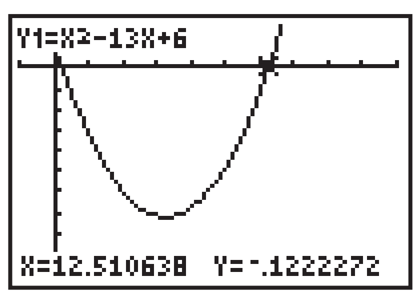
Section 9.2 Page 485 Question 9

a) $x^2 - 3x + 6 \leq 10x$

$x^2 - 13x + 6 \leq 0$

Graph $y = x^2 - 13x + 6$ to check where the function is below the x-axis.

Use the quadratic formula to determine the roots.



$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-13) \pm \sqrt{(-13)^2 - 4(1)(6)}}{2(1)}$$

$$x = \frac{13 \pm \sqrt{145}}{2}$$

The solution set is $\{x \mid \frac{13 - \sqrt{145}}{2} \le x \le \frac{13 + \sqrt{145}}{2},\ x \in \mathrm{R}\}$.

b) $2x^2 + 12x - 11 > x^2 + 2x + 13$

$x^2 + 10x - 24 > 0$

$(x + 12)(x - 2) > 0$

Case 1: Both factors are positive.

$x + 12 > 0$ and $x - 2 > 0$

$x > -12$ and $x > 2$

Both conditions hold for $x > 2$.

Case 2: Both factors are negative.

$x + 12 < 0$ and $x - 2 < 0$

$x < -12$ and $x < 2$

Both conditions hold for $x < -12$.

The solution set is $\{x \mid x < -12 \text{ or } x > 2,\ x \in \mathrm{R}\}$.

c) $x^2 - 5x < 3x^2 - 18x + 20$

$0 < 2x^2 - 13x + 20$

$0 < (2x - 5)(x - 4)$

Case 1: Both factors are positive.

$2x - 5 > 0$ and $x - 4 > 0$

$x > \frac{5}{2}$ and $x > 4$

Both conditions hold for $x > 4$.

Case 2: Both factors are negative.

$2x - 5 < 0$ and $x - 4 < 0$

$x < \frac{5}{2}$ and $x < 4$

Both conditions are true when $x < \frac{5}{2}$.

The solution set is $\{x \mid x < \frac{5}{2} \text{ or } x > 4,\ x \in \mathrm{R}\}$.

d) $-3(x^2 + 4) \le 3x^2 - 5x - 68$

$$-3x^2 - 12 \le 3x^2 - 5x - 68$$
$$0 \le 6x^2 - 5x - 56$$
$$0 \le (3x + 8)(2x - 7)$$

Case 1: Both factors are positive.

$3x + 8 \ge 0$ and $2x - 7 \ge 0$

$x \ge -\frac{8}{3}$ and $x \ge \frac{7}{2}$

Both inequalities are true when $x \ge \frac{7}{2}$.

Case 2: Both factors are negative.

$3x + 8 \le 0$ and $2x - 7 \le 0$

$x \le -\frac{8}{3}$ and $x \le \frac{7}{2}$

Both inequalities are true when $x \le -\frac{8}{3}$.

The solution set is $\{x \mid x \le -\frac{8}{3} \text{ or } x \ge \frac{7}{2},\ x \in \mathrm{R}\}$.

Section 9.2 Page 485 Question 10

a) $9h^2 \ge 750$

$$h^2 \ge \frac{750}{9}$$

Since h represents thickness of ice, only the positive root has meaning in the context.

$h \ge \frac{5\sqrt{30}}{3}$.

Ice that is $\frac{5\sqrt{30}}{3}$ cm (approximately 9.13 cm) or thicker will support the vehicle.

b) The inequality $9h^2 \ge 1500$ can be used to find the thickness of ice that will support a mass of 1500 kg.

c) $h^2 \ge \frac{1500}{9}$

Since h represents thickness of ice, only the positive root has meaning in the context.

$h \ge \frac{10\sqrt{15}}{3}$.

Ice that is $\dfrac{10\sqrt{15}}{3}$ cm (approximately 12.91 cm) or thicker will support the vehicle.

d) The relationship between ice thickness and mass is quadratic, so the thickness does not double for double the mass. The thickness increases by a factor of $\sqrt{2}$ when the mass doubles.

Section 9.2 Page 486 Question 11

a) Let x represent the radius, in metres, of the circular area.
The area irrigated is 63 ha, or 63(10 000) m^2.
Then the inequality that models the area that Murray can irrigate is $\pi x^2 \le 630\ 000$.

b) Solve $\pi x^2 \le 630\ 000$. Since x represents a length, only positive roots need to be considered.

$$0 \le x \le \sqrt{\frac{630\ 000}{\pi}} \text{ or } 0 \le x \le 100\sqrt{\frac{63}{\pi}}$$

c) The radius is between 0 m and 447.81 m.

Section 9.2 Page 486 Question 12

a) Substitute $P = 10$ in $-t^2 + 14 \le P$.

$$-t^2 + 14 \le 10$$
$$4 \le t^2$$

Since t represents years from the present, only the positive root needs to be considered.

$t \ge 2$

Carbon fibre will be \$10/kg or less, 2 years or more from now.

b) Negative solutions for the inequality do not make sense in the context of time from now.

c) Substitute $P = 5$ in $-t^2 + 14 \le P$.

$$-t^2 + 14 \le 5$$
$$9 \le t^2$$
$$t \ge 3$$

Carbon fibre will be \$5/kg or less, 3 years or more from now.