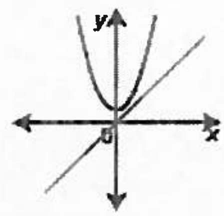
c) Since a represents age the negative results do not make sense. A realistic solution set is $\{a \mid 0 < a \leq 33, a \in \mathrm{R}\}$.

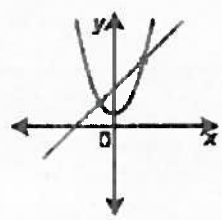
Cumulative Review, Chapters 8–9

Cumulative Review, Chapters 8–9 Page 508 Question 1

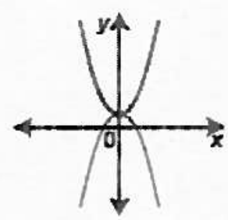
a) The graph is a linear-quadratic system, and matches B because the line has y-intercept 0.
$y = x^2 + 1$
$y = x$



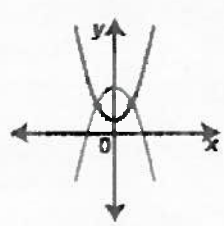
b) The graph is a linear-quadratic system, and matches D.
$y = x^2 + 1$
$y = x + 4$



c) The graph is a quadratic-quadratic system, and matches A, because both parabolas have y-intercept 1 and open in different directions.
$y = x^2 + 1$
$y = -x^2 + 1$

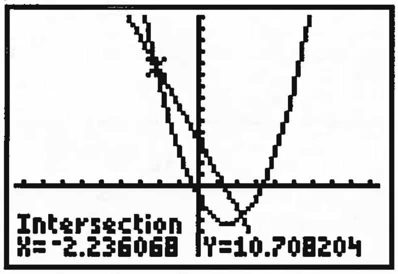


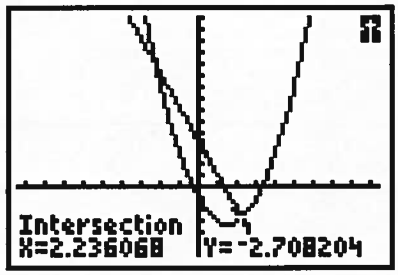
d) The graph is a quadratic-quadratic system, and matches C, because the parabolas have different y-intercepts and open in different directions.
$y = x^2 + 1$
$y = -x^2 + 4$



Cumulative Review, Chapters 8–9 Page 508 Question 2

$3x + y = 4$
$\quad y = -3x + 4$
$y = x^2 - 3x - 1$





To the nearest tenth, the solutions are (–2.2, 10.7) and (2.2, –2.7).

Cumulative Review, Chapters 8–9 Page 508 Question 3

a) $y = -x^2 + 4x + 1$ ①
$3x - y - 1 = 0$ ②
Rearrange ②, $y = 3x - 1$. Substitute into ①.
$3x - 1 = -x^2 + 4x + 1$
$x^2 - x - 2 = 0$
$(x + 1)(x - 2) = 0$
$x = -1$ or $x = 2$
Substitute into ② to find the corresponding y-values.

When $x = -1$:
$3(-1) - y - 1 = 0$
$y = -4$

When $x = 2$:
$3(2) - y - 1 = 0$
$y = 5$

The solutions are (–1, –4) and (2, 5).

b) The ordered pairs are the coordinates of the two points where the line intersects the parabola.

Cumulative Review, Chapters 8–9 Page 508 Question 4

$y = x^2 + 4$ ①
$y = x + b$ ②
Substitute from ② into ①.
$x + b = x^2 + 4$
$x^2 - x + 4 - b = 0$
Solve using the quadratic formula with $a = 1$, $b = -1$, and $c = 4 - b$.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(4-b)}}{2(1)}$$
$$x = \frac{1 \pm \sqrt{4b-15}}{2}$$

a) For two solutions the discriminant is greater than 0.

$4b - 15 > 0$

$b > \frac{15}{4}$ or $b > 3.75$

b) For exactly one solution the discriminant is 0.

$4b - 15 = 0$

$b = \frac{15}{4}$ or 3.75

c) For no real solution the discriminant is less than 0.

$4b - 15 < 0$

$b < \frac{15}{4}$ or $b < 3.75$

Cumulative Review, Chapters 8–9 Page 508 Question 5

<table>
<tr><th colspan="3">Solving Linear-Quadratic Systems</th></tr>
<tr><th>Substitution Method</th><th colspan="2">Elimination Method</th></tr>
<tr><td>Determine which variable to solve for first.</td><td>Determine which variable to eliminate.</td><td>Multiply the linear equation as needed.</td></tr>
<tr><td>Solve the linear equation for the chosen variable.</td><td colspan="2" rowspan="2">Add the new linear equation and the quadratic equation.</td></tr>
<tr><td>Substitute the expression for the variable into the quadratic equation and simplify.</td></tr>
<tr><td colspan="3">Solve the new quadratic equation.</td></tr>
<tr><td>No Solution</td><td colspan="2">Substitute the value(s) into the original linear equation to determine the corresponding value(s) of the other variable.</td></tr>
</table>

Cumulative Review, Chapters 8–9 Page 508 Question 6

<table>
<tr><th colspan="3">Solving Quadratic-Quadratic Systems</th></tr>
<tr><th>Substitution Method</th><th colspan="2">Elimination Method</th></tr>
<tr><td>Solve one quadratic equation for the y-term.</td><td>Eliminate the y-term.</td><td>Multiply the equations as needed.</td></tr>
<tr><td>Substitute the expression for the y-term into the other quadratic equation and simplify.</td><td colspan="2">Add the new equations.</td></tr>
<tr><td colspan="3">Solve the new quadratic equation.</td></tr>
<tr><td>No Solution</td><td colspan="2">Substitute the value(s) into an original equation to determine the corresponding value(s) of the other variable.</td></tr>
</table>

Cumulative Review, Chapters 8–9 Page 508 Question 7

$P = 14 + 12t - t^2$ ①
$P = 2t + 30$ ②
Substitute from ② into ①.
$2t + 30 = 14 + 12t - t^2$
$t^2 - 10t + 16 = 0$
$(t - 2)(t - 8) = 0$
$t = 2$ or $t = 8$
Substitute into ② to find the corresponding P-values.

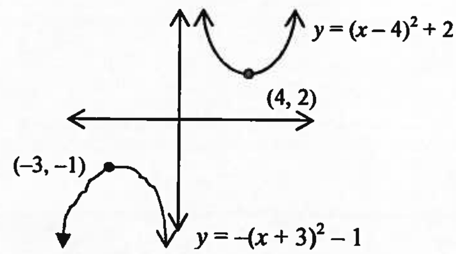
When $t = 2$:
$P = 2(2) + 30$
$P = 34$

When $t = 8$:
$P = 2(8) + 30$
$P = 46$

The two stocks will be the same price after 2 years, when the price of each stock is \$34, and after 8 years when the price of each stock is \$46.

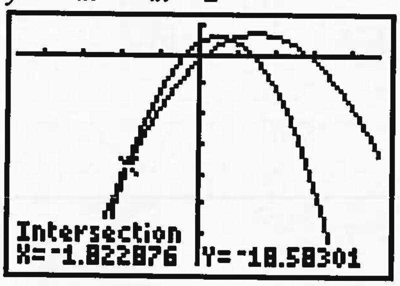
Cumulative Review, Chapters 8–9 Page 509 Question 8

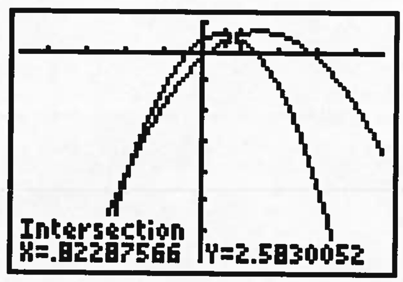
$y = (x - 4)^2 + 2$
$y = -(x + 3)^2 - 1$
From the first equation, the vertex is at (4, 2) and the parabola opens upward.
From the second equation, the vertex is at (−3, −1) and the parabola opens downward.
A quick sketch shows that these two parabolas never intersect.
The system has no solution.



Cumulative Review, Chapters 8–9 Page 509 Question 9

$y = -2x^2 + 6x - 1$
$y = -4x^2 + 4x + 2$





To the nearest tenth the solutions are (−1.8, −18.6) and (0.8, 2.6).

Cumulative Review, Chapters 8–9 Page 509 Question 10

a) $y = 2x^2 + 9x - 5$ ①
$y = 2x^2 - 4x + 8$ ②
Substitute from ① into ②.
$2x^2 + 9x - 5 = 2x^2 - 4x + 8$
$13x = 13$
$x = 1$
Substitute into ① to determine the corresponding y-value.
$y = 2(1)^2 + 9(1) - 5$
$y = 6$
The solution is (1, 6).

b) $y = 12x^2 + 17x - 5$ ①
$y = -x^2 + 30x - 5$ ②
Substitute from ① into ②.

$$12x^2 + 17x - 5 = -x^2 + 30x - 5$$
$$13x^2 - 13x = 0$$
$$13x(x - 1) = 0$$
$$x = 0 \text{ or } x = 1$$

Substitute into ② to determine the corresponding y-values.

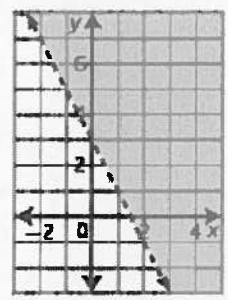
When $x = 0$:
$y = -(0)^2 + 30(0) - 5$
$y = -5$

When $x = 1$:
$y = -(1)^2 + 30(1) - 5$
$y = 24$

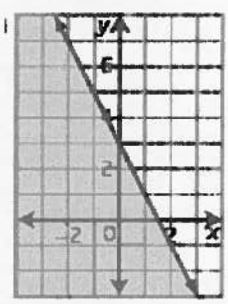
The solutions are $(0, -5)$ and $(1, 24)$.

Cumulative Review, Chapters 8–9 Page 509 Question 11

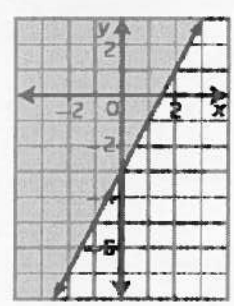
a) The line has slope –2 and y-intercept 3. So, the equation to the boundary line is $y = -2x + 3$. The boundary is a dashed line and the region above it is shaded.
The inequality that describes this graph is $y > -2x + 3$ or $2x + y > 3$.
This matches **D**.



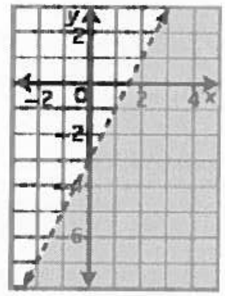
b) This is the same boundary line as in part a), $y = -2x + 3$. The boundary is a solid line and the region below it is shaded.
The inequality that describes this graph is $y \le -2x + 3$ or $2x + y \le 3$.
This matches **A**.



c) The line has slope 2 and y-intercept –3. So, the equation to the boundary line is $y = 2x - 3$. The boundary is a solid line and the region above it is shaded.
The inequality that describes this graph is $y \ge 2x - 3$ or $2x - y \le 3$.
This matches **B**.

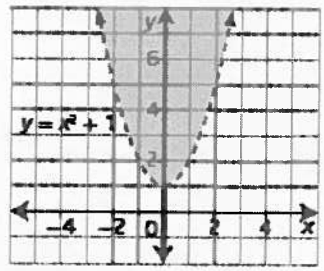


d) This is the same boundary line as in part c), $y = 2x - 3$. The boundary is a dashed line and the region below it is shaded.
The inequality that describes this graph is $y < 2x - 3$ or $2x - y > 3$.
This matches **C**.

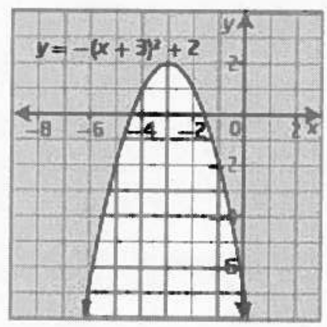


Cumulative Review, Chapters 8–9 Page 509 Question 12

a) Since the boundary is a dashed line and the region above it is shaded an inequality to describe the graph is $y > x^2 + 1$.



b) Since the boundary is a solid line and the region above it is shaded an inequality to describe the graph is $y \geq -(x + 3)^2 + 2$.



Cumulative Review, Chapters 8–9 Page 509 Question 13

a) Test (0, 0) in $y > x - 2$.

Left Side $= y$
$= 0$

Right Side $= x - 2$
$= 0 - 2$
$= -2$

Left Side > Right Side
Since this value yields a true statement, shade the region containing (0, 0).

b) Test (2, –5) in $y > x - 2$.

Left Side $= y$
$= -5$

Right Side $= x - 2$
$= 2 - 2$
$= 0$

Left Side $\not>$ Right Side

Since this value does not check in the inequality, shade the region on the side of the line not containing (2, –5).

c) Test (–1, 1) in $y > x - 2$.

Left Side $= y$
$= 1$

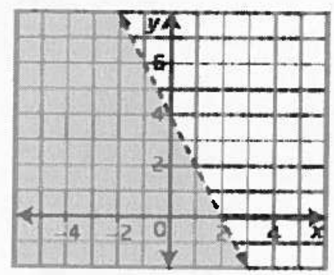
Right Side $= x - 2$
$= -1 - 2$
$= -3$

Left Side > Right Side

Since this value checks in the inequality, shade the region on the side of the line containing (–1, 1).

Cumulative Review, Chapters 8–9 Page 509 Question 14

The boundary line has slope –2 and y-intercept 4, so its equation is $y = -2x + 4$.
The boundary line is dashed and the region below it is shaded so an inequality for the graph is
$y < -2x + 4$.



Cumulative Review, Chapters 8–9 Page 509 Question 15

$y \ge x^2 - 3x - 4$

The boundary is the parabola $y = x^2 - 3x - 4$.

$y = (x - 4)(x + 1)$

The parabola has x-intercepts 4 and –1 and its y-intercept is –4.

Use these points to graph the parabola. It opens upward.

Shade the region above a solid line boundary.

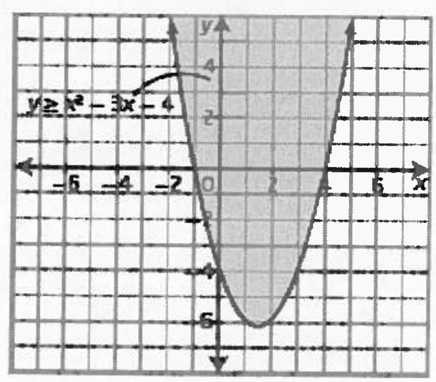
Test (0, 0).

Left Side
y
$= 0$

Right Side
$x^2 - 3x - 4$
$= (0)^2 - 3(0) - 4$
$= -4$

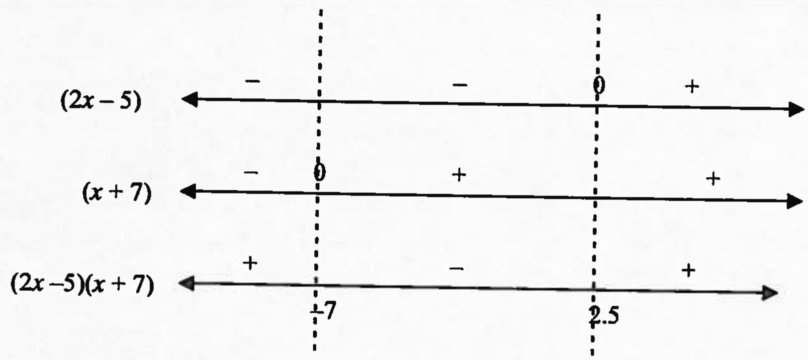
Left Side > Right Side

The correct region is shaded.



Cumulative Review, Chapters 8–9 Page 509 Question 16

$2x^2 + 9x - 33 \geq 2$
$2x^2 + 9x - 35 \geq 0$
$(2x - 5)(x + 7) \geq 0$
Consider key values $x = 2.5$ and $x = -7$, and regions left, right, and between these values.
Substitute 2.5 in $(x + 7)$: $2.5 + 7 = 9.5$ is positive.
Substitute –7 in $(2x - 5)$: $2(-7) - 5 = -19.5$ is negative.
The signs of the factors in each interval are shown on the diagram below.



The solution set is $\{x \mid x \leq -7 \text{ or } x \geq 2.5, x \in \mathrm{R}\}$.

Cumulative Review, Chapters 8–9 Page 509 Question 17

Let x represent the width of the rectangle. Then, $500 - x$ represents the length.
For the area to be greater than 60 000 m^2, the following inequality must be true.

$x(500 - x) > 60\,000$
$-x^2 + 500x - 60\,000 > 0$
$x^2 - 500x + 60\,000 < 0$
$(x - 300)(x - 200) < 0$

Case 1: The first factor is negative and second factor is positive.
$x - 300 < 0$ and $x - 200 > 0$
$x < 300$ and $x > 200$
These two conditions are true for $200 < x < 300$.
Case 2: The first factor is positive and second factor is negative.
$x - 300 > 0$ and $x - 200 < 0$
$x > 300$ and $x < 200$
These two conditions are never both true.
So, the possible widths of the rectangle are between 200 m and 300 m to give an area of greater than 60 000m^2.