8.2 Solving Systems of Equations Algebraically

Warm Up:

Solve System of Linear Equations Algebraically.

$2x + y = 13$

$x + y = 8$

Use Substitution	Use Elimination
$y = -x + 8$ $2x + (-x + 8) = 13$ $2x - x + 8 = 13$ $x = 5$ $y = -(5) + 8$ $y = 3$	$2x + y = 13$ $-(x + y = 8)$ $x = 5$ $5 + y = 8$ $y = 3$

Verify

Verify (5, 3)

LS		RS
$2x + y$	=	13
$2(5) + 3$	=	13
13	=	13 ✓

LS		RS
$x + y$	=	8
$5 + 3$	=	8
8	=	8 ✓

Since (5, 3) satisfies both eqn, it is the soln.

Chapter 8: System of Equations

Solve the system algebraically and verify your solution.

$3x + y = -9$

$4x^2 - x + y = -9$

Use Substitution	Use Elimination
$y = -3x - 9$ $4x^2 - x + (3x - 9) = -9$ $4x^2 - x - 3x - 9 = -9$ $+9 \quad +9$ $4x^2 - 4x = 0$ $4x(x - 1) = 0$ $4x = 0 \qquad x - 1 = 0$ $x = 0 \qquad x = 1$ $y = -3(0) - 9 \qquad y = -3(1) - 9$ $y = -9 \qquad y = -3 - 9$ $y = -12$ $(0, -9) \qquad (1, -12)$	$3x + y = -9$ $-(4x^2 - x + y = -9)$ $-4x^2 + 4x = 0$ $-4x(x - 1) = 0$ $-4x = 0 \qquad x - 1 = 0$ $x = 0 \qquad x = 1$ $(0, -9) \qquad (1, -12)$

Verify

verify $(0, -9)$

LS		RS
$3(0) + (-9)$	$=$	-9
-9	$=$	-9 ✓

$4(0)^2 - (0) + (-9) = -9$

$-9 = -9$ ✓

verify $(1, -12)$

LS		RS
$3(1) + (-12)$	$=$	-9
$3 - 12$	$=$	-9
-9	$=$	-9 ✓

$4(1)^2 - (1) + (-12) = -9$

$4 - 1 + (-12) = -9$

$3 - 12 = -9$ ✓

Both soln are correct.

∴ Two soln are $(0, -9)$ and $(1, -12)$

Chapter 8: System of Equations

Solve the system algebraically and verify your solution.

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

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

Use Substitution

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

$4x^2 - 4x - (6x^2 - x + 1) = -6$

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

$-2x^2 - 3x - 1 = -6$

$-2x^2 - 3x + 5 = 0$

$2x^2 + 3x - 5 = 0$

$(2x + 5)(x - 1) = 0$

$2x + 5 = 0$ $\quad$ $x - 1 = 0$

$2x = -5$ $\quad$ $x = 1$

$x = -2.5$

$6(-2.5)^2 - (-2.5) + 1 = y$

$37.5 + 2.5 + 1 = y$

$41 = y$

$(-2.5, 41)$

$6(1)^2 - (1) + 1 = y$

$6 - 1 + 1 = y$

$6 = y$

$(1, 6)$

Use Elimination

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

$-(4x^2 - 4x - y = -6)$

$2x^2 + 3x = 5$

$2x^2 + 3x - 5 = 0$

$(2x + 5)(x - 1) = 0$

$2x + 5 = 0$ $\quad$ $x - 1 = 0$

$x = -2.5$ $\quad$ $x = 1$

$6(-2.5)^2 - (-2.5) - y = -1$

$(-2.5, 41)$

$6(1)^2 - (1) - y = -1$

$(1, 6)$

Verify

verify $(-2.5, 41)$

LS $\quad$ RS

$6(-2.5)^2 - (-2.5) - (41) = -1$

$-1 = -1$ ✓

$4(-2.5)^2 - 4(2.5) - (41) = -6$

$-6 = -6$ ✓

verify $(1, 6)$

LS $\quad$ RS

$6(1)^2 - 1 - 6 = -1$

$5 - 6 = -1$ ✓

$4(1)^2 - 4(1) - 6 = -6$

$0 - 6 = -6$ ✓

Both soln are correct

∴ The system has two soln: $(-2.5, 41)$ and $(1, 6)$

Suppose the crate's height above the ground is given by the following two equations. (p. 445)

$h = -4.9t^2 + 900$

$h = -4t + 500$

a) How long after the crate leaves the aircraft does the parachute open? Express your answer to the nearest hundredth of a second.

Use substitution

$-4.9t^2 + 900 = -4t + 500$

$-4.9t^2 + 4t + 900 - 500 = 0$

$-4.9t^2 + 4t + 400 = 0$

$a = -4.9$, $b = 4$, $c = 400$

$t = \dfrac{-4 \pm \sqrt{4^2 - 4(-4.9)(400)}}{2(-4.9)}$

≈ -8.64 reject

≈ 9.45

The parachute opens about 9.45s after the crate leaves.

b) What height above the ground is the crate when the parachute opens? Express your answer to the nearest meter.

use ANS button or use up to 4 decimal places

$h = -4(9.45) + 500$

$= 462.19$

When the parachute opens, the crate is 462m above the ground.

c) Verify your solution.

(9.45, 462)

LS = RS

$462 = -4.9(9.45)^2 + 900$

$462 = 462$ ✓

The soln is correct.

Chapter 8: System of Equations

Benjamin makes a good hit and the baseball travels on a path modelled by $h = -0.1x^2 + 2x$. Leah is in the outfield directly in line with the path of the ball. She runs toward the ball and jumps to try to catch it. Her jump is modelled by the equation $h = -x^2 + 39x - 378$. In both equations, x is the horizontal distance in meters from home plate and h is the height of the ball above the ground in meters.

a) Solve the system algebraically. Round your answer to the nearest hundredth.

Using elimination

$h = -0.1x^2 + 2x$

$-(h = -x^2 + 39x - 378)$

$0 = 0.9x^2 - 37x + 378$

use quadratic formula

$$x = \frac{-(-37) \pm \sqrt{(-37)^2 - 4(0.9)(378)}}{2(0.9)}$$

$$= \frac{37 \pm \sqrt{1369 - 1360.8}}{1.8}$$

$$= \frac{37 \pm \sqrt{8.2}}{1.8}$$

$= 22.15$

$= 18.96$

Now plug in the x-values.

$h = -0.1(22.15)^2 + 2(22.15)$

$= -4.75$ Reject

$h = -0.1(18.96)^2 + 2(18.96)$

$= 1.96$

(18.96, 1.96)

b) Explain the meaning of the point of intersection. What assumptions are you making?

Leah catches the baseball jumping 1.96m above the ground and 18.96m running on the field.

(you can write this better...)

Assumptions: wind frictions

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1 -2 optional

3 (a, d), 4 (a, c), 6 – 9, 11 – 14, 18, 20, 23, 24

pick 4.