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MATHEMATICS

MAT 102

I. $x - y + 14 = 0$ and $x^2 + y^2 - 6x + 8y = 0$

solution

$$x = y + 14$$

$$x^2 + y^2 - 6x + 8y = 0$$

$$(y + 14)^2 + y^2 - 6(y + 14) + 8y = 0$$

$$y^2 + 14y + 14y + 196 - 6y - 84 + 8y = 0$$

$$y^2 + 28y + 196 - 6y - 84 + 8y = 0$$

$$y^2 + 30y + 112 = 0$$

using the quadratic formula

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

$$= \frac{-30 \pm \sqrt{30^2 - 4(1)(112)}}{2}$$

$$= \frac{-30 \pm \sqrt{900 - 448}}{2}$$

$$= \frac{-30 \pm \sqrt{452}}{2}$$

$$= \frac{-30 \pm 21.26}{2}$$

$$= \frac{-30 \pm 21.26}{2}$$

$$2$$

$$= \frac{-30 + 21.26}{2}$$

$$2$$

$$= -4.37$$

$$\frac{-30 - 21.26}{2}$$

$$2$$

$$= \frac{-51.26}{2}$$

$$2$$

$$= -25.63$$

$$(y_1, y_2) = (-4.37, -25.63)$$

$$x = y + 14 \text{ using } -4.37 \Rightarrow x = -4.37 + 14 = 9.63$$

$$x = y + 14 \text{ using } -25.63 \Rightarrow x = -25.63 + 14 = -11.63$$

$$(x_1, x_2) = (9.63, -11.63)$$

$$2x + y - 10 = 0 \text{ and } x^2 + y^2 + 4x - 6y = 0$$

$$y = -2x + 10$$

$$x^2 + (-2x + 10)^2 + 4(x) - 6(-2x + 10) = 0$$

$$x^2 + (-2x + 10)(-2x + 10) + 4x + 12x - 60 = 0$$

$$x^2 + 4x^2 - 20x - 20x + 100 + 4x + 12x - 60 = 0$$

$$5x^2 + 4x^2 - 40x + 100 + 4x + 12x - 60 = 0$$

$$5x^2 - 28x + 40 = 0$$

$$5x^2 - 24x + 40 = 0$$

Using the quadratic formula

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

$$2a$$

$$= \frac{-24 \pm \sqrt{(-24)^2 + 4(5)(40)}}{10}$$

$$= \frac{-24 \pm \sqrt{576 + 800}}{10}$$

$$\frac{-24 \pm \sqrt{1376}}{10}$$

$$\frac{-24 \pm 37.09}{10} \Rightarrow \frac{-24 - 37.09}{10} = -6.109$$

$$\Rightarrow \frac{-24 + 37.09}{10} = 1.309$$

$$10 \quad (x_1, x_2) = (-6.109, 1.309)$$

from $y = -2x + 10$

$$y_1 = -2(-6.109) + 10$$

$$= 12.218 + 10 \Rightarrow 22.218$$

$$y_2 = -2(1.309) + 10$$

$$= -2.618 + 10 = 7.382$$

$$y_1 = 22.218$$

$$y_2 = 7.382$$

$$3. \quad x - 5y - 2 = 0 \text{ and } x^2 + 25y^2 - 6xy - 16 = 0$$

$$x = 5y + 2$$

$$(5y + 2)^2 + 25y^2 - 6(5y + 2)(y) - 16 = 0$$

$$25y^2 + 10y + 10y + 4 + 25y^2 - 30y^2 - 12y - 16 = 0$$

$$-5y^2 + 33y - 12 = 0$$

using quadratic formula

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

$$\frac{-33 \pm \sqrt{33^2 - 4(-5)(-12)}}{2(-5)}$$

$$= \frac{-33 \pm \sqrt{1089 - 240}}{-10}$$

$$= \frac{-33 \pm \sqrt{849}}{-10}$$

$$= \frac{-33 + 29.14}{-10} \Rightarrow \frac{-33 + 29.14}{-10} = 0.386$$

$$\Rightarrow \frac{-33 - 29.14}{-10} = 6.214$$

$$(y_1, y_2) = (0.386, 6.214)$$

Subbing y_1 and y_2 into $x = 5y + 2$

$$x_1 = 5(0.386) + 2 \\ = 3.93$$

$$x_2 = 5(6.214) + 2 \\ = 31.07 + 2 \\ = 33.07$$

$$(x_1, x_2) = (3.93, 33.07)$$