8pts 1. Solve the following system of equations by substitution

\[3x + 2y = 6\]
\[y = 2x - 11\]

\[3x + 2(2x-11) = 6\]
\[3x + 4x - 22 = 6\]
\[-7x = 28\]
\[x = -4\]
\[y = -3\]

8pts 2. Solve the following system of equations by elimination

\[7x - y = 2\]
\[2x + 5y = 27\]

\[37x - 5y = 10\]
\[3x + 5y = 67\]
\[7x = 37\]
\[x = 1\]
\[y = 5\]

8pts 3. There are 25 coins in a child's piggy bank that total $4.45. The coins are all either quarters or nickels. Set up a system of equations and solve it to determine how many of each type of coin there is.

\[N + Q = 25\]
\[5N + 25Q = 445\]

\[5N + 25Q = 445\]
\[-200Q = -320\]
\[Q = 16\]
\[N = 9\]

16 quarters and 9 nickels

8pts 4. If the national consumption function is given by \(C = 0.5y + 12\) (in billions of dollars)

a) What is the national consumption when disposable income is $50(billion)?

\[C(50) = 0.5(50) + 12 = 37\text{ billion}\]

b) What is the marginal propensity to consume?

\[5\]

8pts 5. Graph the solution to the system of inequalities \(5x + 3y \leq 15, x \geq 0, y \geq 0\)

8pts 6. Graph the solution to the system of inequalities \(x \geq 0, y \geq 0, x + y \leq 8, y \geq 2x - 1\)

6pts 7. Using your information from problem 6 Maximize \(C = 5x + 7y\)

If you did not do problem 6 then use the following ordered pairs (these are not the right ones) \{(0,2) (1,4) (4,5) (3,4)\}

\[C(0,2) = 5(0) + 7(2) = 14\]
\[C(1,4) = 5(1) + 7(4) = 33\]
\[C(4,5) = 5(4) + 7(5) = 55\]
\[C(3,4) = 5(3) + 7(4) = 56\]

\[\text{max 56 at (0,8)}\]
(5) \[ \begin{align*} \text{sxt} + 3y &\leq 15 \\ x &\geq 0 \\ y &\geq 0 \end{align*} \]

(6) \[ \begin{align*} x &\geq 0 \\ y &\geq 0 \\ x + y &\leq 8 \\ y &\leq 2x - 1 \\ x + 3x - 1 &\leq 8 \\ 3x &\leq 9 \\ x &\leq 3 \\ (3, 5) \end{align*} \]
(c) \( y = x^2 + 4x - 12 \)

\[
\begin{align*}
(x+6)(x-2) &= 0 \\
y_{\text{int}} &= -2 \\
x_{\text{int}} &= 6, 2 \\
a &= 1, x = -2 \\
V &= (3, -16)
\end{align*}
\]

(\text{c)} \( y = -x^2 + 9 \)

\[
\begin{align*}
x_{\text{int}} &= 3 \\
y_{\text{int}} &= 9 \\
V &= (0, 9)
\end{align*}
\]

(4) \( y = x^3 + 2 \)
6pts 8. Find the maximum value of the feasible region shown below using \( C = 3x + 5y \):

\[
\begin{align*}
C(0, 12) &= 3(0) + 5(12) = 60 \\
C(0, 0) &= 3(0) + 5(0) = 0 \\
C(4, 10) &= 3(4) + 5(10) = 63 \\
C(3\frac{2}{3}, 0) &= 3\frac{2}{3} + 5(0) = \frac{9}{3} = 32
\end{align*}
\]

Max 62 at \((4, 10)\)

8pts 9. Using the quadratic formula: \( x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \) find any solutions to \( 5x^2 + 19x = 12 + 2x \)

\[
x = \frac{-17 \pm \sqrt{17^2 - 4(5)(12)}}{2(5)} = \frac{-17 \pm \sqrt{289}}{10}
\]

\[
\begin{align*}
5x^2 + 17x - 12 &= 0 \\
5x^2 &+ 17x - 12 = 0
\end{align*}
\]

\[
3 \text{ or } -4
\]

8pts 10. Solve by factoring \( x^2 - 21x + 54 = 0 \)

\[
(x - 3)(x - 18) = 0
\]

\[
x = 3 \text{ or } 18
\]

6pts 11. Graph \( y = x^2 - 4x - 12 \) see graph paper

axis of symmetry \( x = \frac{-b}{2a} \)

6pts 12. Graph \( y = -x^2 + 9 \) see graph paper

6pts 13. If the supply function for a commodity is \( p = q^2 - 4q + 23 \) and the demand function is \( p = -2q^2 + 11q + 173 \) find the equilibrium quantity and price.

\[
\begin{align*}
q^2 - 4q + 23 &= -2q^2 + 11q + 173 \\
3q^2 - 15q - 150 &= 0 \\
3q^2 - 5q - 50 &= 0
\end{align*}
\]

\[
q = 10, \quad q = -5
\]

\[
p = 83
\]

6pts 14. Graph \( y = x^3 + 2 \) see graph paper