1. **(4 points)** *Solve the following system of equations. Show your work.*

$$\begin{cases} 3x - 2y = 1 \\ x + 3y = -7 \end{cases}$$

The cleanest substitution uses the second equation to express x in terms of y: $x = -7 - 3y$. Substituting this back into the first line eliminates x, leaving an equation in y:

$$\begin{aligned} 3(-7-3y) - 2y &= 1 \\ -21 - 9y - 2y &= 1 \\ -11y &= 22 \\ y &= -2 \end{aligned}$$

And then by our original solution for x in terms of y, $x = -7 - 3(-2) = -7 + 6 = -1$, so the solution is $x = -1$, $y = -2$, or $(-1, -2)$.

2. **(6 points)** *In pre-decimal British currency, a sixpence is a coin worth 6 cents, and a penny is a coin worth 1 cent. We have a collection of 70 coins of these two types which have a total value of 240 cents (or a pound sterling). Set up and solve a system of equations to determine how many coins of each type we have.*

Let s be the number of sixpence in our collection; let p be the number of pennies. Since there are 70 coins in total, $s+p = 70$, and since the total value of the coins is 240 cents, $6s+p = 240$, so our system is

$$\begin{cases} s + p = 70 \\ 6s + p = 240 \end{cases}$$

Using the substitution method, we can solve for s in terms of p in the first equation: $s = 70 - p$, and then substitute back in to the second equation:

$$\begin{aligned} 6(70-p) + p &= 240 \\ 420 - 6p + p &= 240 \\ -5p &= -180 \\ p &= 36 \end{aligned}$$

and from our original solution for s, we know $s = 70 - p = 34$, so this collection includes 36 pennies and 34 sixpence.

3. **(5 points)** *Solve the following system of equations. Show your work.*

$$\begin{cases} x - 2y + z = -5 \\ 2x + 3y = 8 \\ 3x - 6y - 4z = -1 \end{cases}$$

Using the substitution method, we can solve for x to get $x = -5 + 2y - z$, which substitutes into the other two equations to give:

$$\begin{cases} 2(-5+2y-z) + 3y = 8 \\ 3(-5+2y-z) - 6y - 4z = -1 \end{cases}$$

We now distribute the multiplication and collect terms to get

$$\begin{cases} 7y - 2z = 18 \\ \qquad -7z = 14 \end{cases}$$

The last equation gives $z = -2$; substituting into its predecessor, we have $7y = 18 + 2z = 18 - 4 = 14$, so $y = 2$; finally, since $x = -5 + 2y - z$, it follows that $x = -5 + 2(2) - (-2) = 1$.