In these problems, do not use decimals in your answers: only use fractions or radicals in fully simplified form. Write complex numbers in the form $a + bi$

1a) Find the equation of the line which passes through the points $(-2, 1)$ and $(0, -3)$. Put it in slope-intercept form.
The slope of this line is $\frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{-3-1}{0-(-2)} = \frac{-4}{2} = -2$
So we know that the equation of the line has the form $y = -2x + b$, and from the information given in the problem the y-intercept is the point $(0, -3)$.
The equation of the line is $y = -2x - 3$

1b) Find the equation of the line parallel to the line in part (a), which passes through the point $(1, 1)$. Put it in slope-intercept form.
This line has the same slope as the line in part (a), namely, -2. So its equation has the form $y = -2x+b$.
This time we have not been given the y-intercept, so we use the fact that $(1, 1)$ is a point on the line to find b:
$1 = -2(1) + b$
$1 = -2 + b$
$3 = b$
So the equation of the line is $y = -2x + 3$

1c) Find the equation of the line perpendicular to the line in part (a), which passes through the point $(2, 3)$. Put it in slope-intercept form.
The slope of the perpendicular line is the negative reciprocal of -2, which is $-\frac{1}{-2} = \frac{1}{2}$
So the equation of this line has the form $y = \frac{1}{2}x + b$, qand we use the given point to find b.
$3 = \frac{1}{2}(2) + b$
$3 = 1 + b$
$2 = b$
So the equation of this line is $y = \frac{1}{2}x + 2$

2) **Solve the system of equations. Indicate your final answer clearly, and check your answer.**

$$\begin{aligned} -x + y + 2z &= 2 \\ x + y + 3z &= 17 \\ -3x - y + z &= -7 \end{aligned}$$

There are many ways to solve this system, but in all of the efficient ways we follow the same strategy:
Use any two equations to eliminate one of the variables
Use a different pair of equations to eliminate the same variable
Solve the resulting 2 by 2 system
Substitute back into one of the original equations to find the third variable (the one eliminated in the first step)

Here is one way: it's a good idea to think about why I made the particular choices I did
Use the first and second equations to eliminate x:

$$\begin{aligned} -x + y + 2z &= 2 \\ x + y + 3z &= 17 \\ \hline 2y + 5z &= 19 \end{aligned}$$

Now use the second and third equations to eliminate x again:

$$\left.\begin{array}{r} 3(x+y+3z)=3(17) \\ -3x-y+z=-7 \end{array}\right\} \qquad \begin{array}{r} 3x+3y+9z=51 \\ -3x-y+z=-7 \\ \hline 2y+10z=44 \end{array}$$

Now we have a 2 by 2 system:
$2y+5z=19$
$2y+10z=44$
Subtract the first of those equations from the second to eliminate y:

$$\left.\begin{array}{r} 2y+10z=44 \\ -(2y+5z)=-19) \end{array}\right\} \qquad \begin{array}{r} 2y+10z=44 \\ -2y-5z=-19 \\ \hline 5z=25 \end{array}$$

and we get $5z=25 \implies z=5$
Substitute back into one of the equations in the 2 by 2 system to find y: I will use the second equation
$2y+10(5)=44 \implies 2y+50=44 \implies 2y=-6 \implies y=-3$
Now choose one of the equations in the original 3 by 3 system to find x: I will use the second one
$x+(-3)+3(5)=17$
$x-3+15=17$
$x+12=17$
$x=5$

The solution to the 3 by 3 system is $(5,-3,5)$

3) Factor $9x^6+12x^8=3x^6\left(3+4x^2\right)$

4) Factor $35AB+21A+25B+15$
Do this by grouping:
$35AB+21A+25B+15$
$=7A(5B+3)+5(5B+3)$
$=(7A+5)(5B+3)$

5) Use the AC method to factor $5x^2-19x-30$
We want two numbers whose product is -150 and whose sum is -19: they are -25 and 6. Use them to split the middle term
$5x^2-19x-30$
$=5x^2-25x+6x-30$
Factor by grouping:
$=5x(x-5)+6(x-5)$
$=(5x+6)(x-5)$

6) Factor $16x^2-y^6$
This is a difference of squares:
$16x^2-y^6=(4x)^2-\left(y^3\right)^2=\left(4x-y^3\right)\left(4x+y^3\right)$

7) Solve by using the Zero Product Property:
$x^2 - x - 20 = 0$
$(x-5)(x+4) = 0$
$\implies x - 5 = 0$ or $x + 4 = 0$ (the Zero Product Property)
$x - 5 = 0 \implies x = 5$
$x + 4 = 0 \implies x = -4$
So $x = 5$ or $x = -4$ (answer)
If you want to write your answer as a solution set, write $\{5, -4\}$, or you can write $x \epsilon \{5, -4\}$. The symbol ϵ means that x is one of the numbers in the set: in more formal language, we say "x is an element of the set $\{5, -4\}$"
But whatever you do, make sure you've used the notation correctly and never write that x equals the set, that is WRONG. It's better to avoid writing in set language if you don't totally understand what it means.

8) Solve by using the Square Root Property:
$x^2 = 49$
$\implies x = \pm\sqrt{49}$ (the Square Root Property)
$x = \pm 7$ (answer), or you can write: $x = 7$ or $x = -7$
If you want to write your answer as a solution set, write $\{7, -7\}$, or you can write $x \epsilon \{7, -7\}$

9) Solve by using the Square Root Property: do not use decimal approximations in your answer.
$\left(x - \frac{3}{7}\right)^2 = \frac{16}{49}$
$\left(x - \frac{3}{7}\right) = \pm\sqrt{\frac{16}{49}}$ (the Square Root Property)
$\left(x - \frac{3}{7}\right) = \pm\frac{4}{7}$
$x = \frac{3}{7} \pm \frac{4}{7}$
Now we have to split into two equations in order to finish simplifying:
$x = \frac{3}{7} + \frac{4}{7} = \frac{7}{7} = 1$
or
$x = \frac{3}{7} - \frac{4}{7} = -\frac{1}{7}$

Answer: $x = 1$ or $x = -\frac{1}{7}$
If you want to write your answer as a solution set, write $\{1, -\frac{1}{7}\}$, or you can write $x \epsilon \{1, -\frac{1}{7}\}$