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 $(2, -3)$ and $(0, 1)$. Put it in slope-intercept form.
The slope of this line is $\frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{1-(-3)}{0-2} = \frac{4}{-2} = -2$
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 $(0, 1)$.
The equation of the line is $y = -2x + 1$

1b) Find the equation of the line parallel to the line in part (a), which passes through the point $(2, -2)$. 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 $(2, -2)$ is a point on the line to find b:
$-2 = -2(2) + b$
$-2 = -4 + b$
$2 = b$
So the equation of the line is $y = -2x + 2$

1c) Find the equation of the line perpendicular to the line in part (a), which passes through the point $(-3, -1)$. 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.
$-1 = \frac{1}{2}(-3) + b$
$-1 = -\frac{3}{2} + b$
$-1 + \frac{3}{2} = b$
$-\frac{1}{2} = b$
So the equation of this line is $y = \frac{1}{2}x - \frac{1}{2}$

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

$$\begin{aligned} x - y - 2z &= -2 \\ 2x - 3y - 3z &= -1 \\ -2x - y + z &= -5 \end{aligned}$$

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:
Use the first and second equations to eliminate x:

$$\left.\begin{aligned} -2(x - y - 2z) &= -2(-2) \\ 2x - 3y - 3z &= -1 \end{aligned}\right\} \qquad \begin{aligned} -2x + 2y + 4z &= 4 \\ 2x - 3y - 3z &= -1 \\ \hline -y + z &= 3 \end{aligned}$$

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

$$\left.\begin{array}{r} 2(x-y-2z)=2(-2) \\ -2x-y+z=-5 \end{array}\right\} \qquad \begin{array}{r} 2x-2y-4z=-4 \\ -2x-y+z=-5 \\ \hline -3y-3z=-9 \end{array}$$

That result can be divided on both sides by -3:
$\frac{-3y}{-3}+\frac{-3z}{-3}=\frac{-9}{-3}$
$y+z=3$

Now we have a 2 by 2 system:
$-y+z=3$
$y+z=3$
Add those equations together to eliminate y and we get $2z=6 \implies z=3$
Substitute back into one of the equations in the 2 by 2 system to find y: I will use the second equation
$y+3=3 \implies y=0$
Now choose one of the equations in the original 3 by 3 system to find x: I will use the first one
$x-0-2(3)=-2$
$x-6=-2$
$x=4$

The solution to the 3 by 3 system is $(4,0,3)$

3) Factor $49x^{12}+14x^8=7x^8\left(7x^4+2\right)$

4) Factor $42AB-35A-30B+25$
Do this by grouping:
$42AB-35A-30B+25$
$=7A(6B-5)-5(6B-5)$
$=(7A-5)(6B-5)$

5) Use the AC method to factor $5x^2-21x+4$
We want two numbers whose product is 20 and whose sum is -21: they are -20 and -1. Use them to split the middle term
$5x^2-21x+4$
$=5x^2-20x-1x+4$
Factor by grouping:
$=5x(x-4)-1(x-4)$
$=(5x-1)(x-4)$

6) Factor x^2-81y^6
This is a difference of squares:
$x^2-81y^6=x^2-\left(9y^3\right)^2=\left(x-9y^3\right)\left(x+9y^3\right)$

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:
$x^2 = 16$
$\implies x = \pm\sqrt{16}$ (the Square Root Property)
$x = \pm 4$ (answer), or you can write: $x = 4$ or $x = -4$
If you want to write your answer as a solution set, write $\{4, -4\}$, or you can write $x\epsilon\{4, -4\}$

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 $x\epsilon\{1, -\frac{1}{7}\}$