1: First we should set up the variables and determine what equations we have. Let n, d, q be the number of nickels, dimes, quarters respectively. Because she has 300 coins, we know $n+d+q = 300$. Because they are worth \$42, we know $0.05n+0.10d+0.25q = 42$. Multiply by 20 to clear the decimals and get $n+2d+5q = 840$.

(a): Subtract the 2 equations to get $d+4q = 540$, so $d = 540-4q$ and $n = 300-d-q = 3q-240$. The number of nickels can't be negative, so we know $n \geq 0$, which gives $q \geq 80$. Similarly $d \geq 0$, which gives $135 \geq q$.

The number of quarters must be an integer (we shall assume Janice is not cutting coins into pieces and assessing the pieces because quarters today are not made out of silver and she is not a pirate from the 1700s), so $q = 80, 81, \ldots, 135$, which is 56 combinations.

(b): Substitute $q = 100$ into the equations we found in (a) for d and n to get $d = 140$, $n = 60$.

2: First we should set up the variables and determine what equations we have. Let x, y, z be the proportion invested in stocks, bonds, money market respectively. Everything must go into exactly one of those 3 possibilities, so $x+y+z = 1$. Since 6% of their capital is \$6000, the income from stocks will be 6x thousand dollars. Similarly, we get the income from bonds, money market as 4000y, 2000z (in thousands) respectively. The target income is 5 thousand, so $6x+4y+2z = 5$.

After dividing the 2nd equation by 2, we have the system $\{x+y+z = 1, 3x+2y+z=2.5\}$. Subtract to get $\{x+y+z=1, 2x+y = 1.5\}$. Thus, $y = 1.5 - 2x$, $z = 1-x-y = x-0.5 \rightarrow (x,y,z) = (t, 1.5-2t, t-0.5)$ where we have $0.75 \geq t \geq 0.5$ because proportions must be non-negative.

There are infinitely many solutions. Pick any valid t and translate from proportions back to total amounts to get a specific option, and then pick another t to get a 2nd option. Answers will vary.

3: From the 2nd equation, $x = 2+z$. Plug this into the 1st and solve for y to get $y = 1-z$. Plug this into the last equation to get $(k-1)z = 0$. If $k \neq 1$, the only solution is $z = 0$, which means $x = 2$ and $y = 1$. So to get infinitely many solutions, we need $k = 1$.

In the case $k = 1$, we've got everything in terms of z already, so set $z = t$. Then $y = 1-z = 1-t$ and $x = 2+z = 2+t$, so $(x,y,z) = (2+t, 1-t, t)$ where t is any real number.