Solve the following equations by factoring.
Solutions

1.

$$3x^2 - 13x - 10 = 0$$
$$3x^2 - 15x + 2x - 10 = 0$$
$$3x(x-5) + 2(x-5) = 0$$
$$(x-5)(3x+2) = 0$$
$$x - 5 = 0 \qquad 3x + 2 = 0$$
$$x = 5 \qquad x = -\tfrac{2}{3}$$

I used the AC method to factor the left side. Once you're at the $(x - 5)(3x + 2) = 0$ stage, you want to see it as saying that the product of two numbers is zero. That must mean one of the two numbers is zero itself. So set the first number, $x – 5$, equal to zero and solve. And set the second number, $3x + 2$, equal to zero and solve. Notice both solutions make the original equation true.

2.

$$(2x-1)(x^2+1) = 0$$
$$2x - 1 = 0 \qquad x^2 + 1 = 0$$
$$x = \tfrac{1}{2} \qquad x^2 = -1$$
$$x = \pm\sqrt{-1}$$

Here, the left side is already factored and that's equal to zero. So go directly to saying each factor could be zero. Solve $2x – 1 = 0$ to get the first solution. Try to solve $x^2 + 1 = 0$. You get $x^2 = -1$ when you subtract 1 from both sides. Now, this says that when you square some number (we'll call it x), you get -1. But that number does not exist in the real numbers. So this is actually a complex solution. If you want to write the solution as I did, you can. You could also just say there is no real solution from that side. The only real solution is ½.

3.

$$(x+3)^2 = 9$$
$$x^2 + 6x + 9 = 9$$
$$x^2 + 6x = 0$$
$$x(x+6) = 0$$
$$x = 0 \qquad x + 6 = 0$$
$$x = -6$$

Here, the right side is not zero. So we cannot start by setting each factor to zero. This product is 9, not zero. So we have to get zero on one side. From experience, I know I'll need to multiply out the left and then subtract that 9 from both sides to get the left in factored form and zero on the right. I do that. On the third line, I have zero on the right. If I factor the left, I can go from there. So I find a common factor of x between the two terms x^2 and $6x$. Factor it out. Now, on the fourth line, we finally have a product equals zero. Set each factor to zero and solve. This same problem was solved on "Solving equations" but using a different method.