Factor Quadratic Equations by Grouping

Identify the quadratic equation

$$7n^2 + 39n + 20 = 0$$

Multiply the first and last terms

$$7n^2 \times 20 = 140n^2$$

Find two factors of the product of the first and last term that add up to middle term

$140n^2$

$n + 140n = 141n$
$2n + 70n = 72n$
$4n + 35n = 39n \leftarrow 4 \text{ and } 35$
$5n + 28n = 33n$
$7n + 20n = 27n$
$10n + 14n = 24n$

Rewrite the equation where the middle term is separated into those two factors

$$7n^2 + 35n + 4n + 20 = 0$$

Group the first two terms together and the last two terms together

$$(7n^2 + 35n) + (4n + 20) = 0$$

Factor out a common factor from each group

$$7n(n + 5) + 4(n + 5) = 0$$

Factor out the common binomial factor

$$(n + 5)(7n + 4) = 0$$

Solve each factor for the variable

$n + 5 = 0$
$n = -5$

$7n + 4 = 0$
$7n = -4$
$n = -\frac{4}{7}$