4.2.2 - Quadratic Equations

4.2 - Algebra - Solving Equations

Leaving Certificate Mathematics

Ordinary Level & Higher Level

Example 1

Q. Solve for x: $12x^2 - 10x + 10 = 8$.

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Answer:

$$\begin{aligned} 12x^2 - 10x + 10 &= 8 \\ 12x^2 - 10x + 10 - 8 &= 8 - 8 \end{aligned}$$

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Q. Solve for x: $12x^2 - 10x + 10 = 8$.

Answer:

$$\begin{aligned} 12x^2 - 10x + 10 &= 8 \\ 12x^2 - 10x + 10 - 8 &= 8 - 8 \\ 12x^2 - 10x + 2 &= 0 \end{aligned}$$

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Q. Solve for x: $12x^2 - 10x + 10 = 8$.

Answer:

$$\begin{aligned} 12x^2 - 10x + 10 &= 8 \\ 12x^2 - 10x + 10 - 8 &= 8 - 8 \\ 12x^2 - 10x + 2 &= 0 \\ 6x^2 - 5x + 1 &= 0 \end{aligned}$$

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$3x$

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12x^2 - 10x + 10 &= 8 \\
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6x^2 - 5x + 1 &= 0 \\
6x^2 - 3x - 2x + 1 &= 0 \\
3x(2x &
\end{aligned}
$$

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$$3x(2x - 1)$$

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12x^2 - 10x + 10 &= 8 \\
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6x^2 - 3x - 2x + 1 &= 0 \\
3x(2x - 1) \qquad (2x - 1) &= 0
\end{aligned}$$

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Answer:

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\begin{aligned}
12x^2 - 10x + 10 &= 8 \\
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$$

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3x(2x - 1) \qquad (2x - 1) &= 0 \\
(2x - 1)(3x - 1) &= 0
\end{aligned}$$

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$$\begin{aligned} 2x - 1 &= 0 \\ 2x &= 1 \\ x &= \tfrac{1}{2} \end{aligned}$$

$$\begin{aligned} 3x - 1 &= 0 \\ 3x &= 1 \\ &= \tfrac{1}{3} \end{aligned}$$

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$$(2x-1)(3x-1) = 0$$

$$\begin{aligned} 2x - 1 &= 0 \\ 2x &= 1 \\ x &= \tfrac{1}{2} \end{aligned} \qquad \begin{aligned} 3x - 1 &= 0 \\ 3x &= 1 \\ &= \tfrac{1}{3} \end{aligned}$$

$$\therefore \quad x = \tfrac{1}{3},\ \tfrac{1}{2}$$

Example 2

Q. Solve for x: $\frac{2}{3x+1} + \frac{3}{x-1} = \frac{5}{2}$.

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Answer:

$$\frac{2}{3x+1} + \frac{3}{x-1} = \frac{5}{2}$$

$$\frac{2(3x+1)(x-1)(2)}{3x+1}$$

Example 2

Q. Solve for x: $\frac{2}{3x+1} + \frac{3}{x-1} = \frac{5}{2}$.

Answer:

$$\frac{2}{3x+1} + \frac{3}{x-1} = \frac{5}{2}$$

$$\frac{2(3x+1)(x-1)(2)}{3x+1} + \frac{3(3x+1)(x-1)(2)}{x-1}$$

Example 2

Q. Solve for x: $\frac{2}{3x+1} + \frac{3}{x-1} = \frac{5}{2}$.

Answer:

$$\frac{2}{3x+1} + \frac{3}{x-1} = \frac{5}{2}$$

$$\frac{2(3x+1)(x-1)(2)}{3x+1} + \frac{3(3x+1)(x-1)(2)}{x-1} = \frac{5(3x+1)(x-1)(2)}{2}$$

Example 2

Q. Solve for x: $\frac{2}{3x+1} + \frac{3}{x-1} = \frac{5}{2}$.

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$$\frac{2(3x+1)(x-1)(2)}{3x+1} + \frac{3(3x+1)(x-1)(2)}{x-1} = \frac{5(3x+1)(x-1)(2)}{2}$$

$$2(x-1)(2)$$

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$$2(x-1)(2) + 3(3x+1)(2)$$

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Q. Solve for x: $\frac{2}{3x+1} + \frac{3}{x-1} = \frac{5}{2}$.

Answer:

$$\begin{aligned}
\frac{2}{3x+1} + \frac{3}{x-1} &= \frac{5}{2} \\
\frac{2(3x+1)(x-1)(2)}{3x+1} + \frac{3(3x+1)(x-1)(2)}{x-1} &= \frac{5(3x+1)(x-1)(2)}{2} \\
2(x-1)(2) + 3(3x+1)(2) &= 5(3x+1)(x-1)
\end{aligned}$$

Example 2

Q. Solve for x: $\frac{2}{3x+1} + \frac{3}{x-1} = \frac{5}{2}$.

Answer:

$$\frac{2}{3x+1} + \frac{3}{x-1} = \frac{5}{2}$$

$$\frac{2(3x+1)(x-1)(2)}{3x+1} + \frac{3(3x+1)(x-1)(2)}{x-1} = \frac{5(3x+1)(x-1)(2)}{2}$$

$$2(x-1)(2) + 3(3x+1)(2) = 5(3x+1)(x-1)$$

$$4(x-1)$$

Example 2

Q. Solve for x: $\frac{2}{3x+1} + \frac{3}{x-1} = \frac{5}{2}$.

Answer:

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$$\frac{2(3x+1)(x-1)(2)}{3x+1} + \frac{3(3x+1)(x-1)(2)}{x-1} = \frac{5(3x+1)(x-1)(2)}{2}$$

$$2(x-1)(2) + 3(3x+1)(2) = 5(3x+1)(x-1)$$

$$4(x-1) + 6(3x+1)$$

Example 2

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\frac{2}{3x+1} + \frac{3}{x-1} &= \frac{5}{2} \\
\frac{2(3x+1)(x-1)(2)}{3x+1} + \frac{3(3x+1)(x-1)(2)}{x-1} &= \frac{5(3x+1)(x-1)(2)}{2} \\
2(x-1)(2) + 3(3x+1)(2) &= 5(3x+1)(x-1) \\
4(x-1) + 6(3x+1) &= (15x+5)(x-1)
\end{aligned}$$

Example 2

Q. Solve for x: $\frac{2}{3x+1} + \frac{3}{x-1} = \frac{5}{2}$.

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$$2(x-1)(2) + 3(3x+1)(2) = 5(3x+1)(x-1)$$

$$4(x-1) + 6(3x+1) = (15x+5)(x-1)$$

$$4x - 4$$

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Answer:

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\frac{2}{3x+1} + \frac{3}{x-1} &= \frac{5}{2} \\
\frac{2(3x+1)(x-1)(2)}{3x+1} + \frac{3(3x+1)(x-1)(2)}{x-1} &= \frac{5(3x+1)(x-1)(2)}{2} \\
2(x-1)(2) + 3(3x+1)(2) &= 5(3x+1)(x-1) \\
4(x-1) + 6(3x+1) &= (15x+5)(x-1) \\
4x - 4 + 18x + 6 &
\end{aligned}$$

Example 2

Q. Solve for x: $\frac{2}{3x+1} + \frac{3}{x-1} = \frac{5}{2}$.

Answer:

$$\begin{aligned}
\frac{2}{3x+1} + \frac{3}{x-1} &= \frac{5}{2} \\
\frac{2(3x+1)(x-1)(2)}{3x+1} + \frac{3(3x+1)(x-1)(2)}{x-1} &= \frac{5(3x+1)(x-1)(2)}{2} \\
2(x-1)(2) + 3(3x+1)(2) &= 5(3x+1)(x-1) \\
4(x-1) + 6(3x+1) &= (15x+5)(x-1) \\
4x - 4 + 18x + 6 &= 15x(x-1)
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2(x-1)(2) + 3(3x+1)(2) &= 5(3x+1)(x-1) \\
4(x-1) + 6(3x+1) &= (15x+5)(x-1) \\
4x - 4 + 18x + 6 &= 15x(x-1) + 5(x-1) \\
22x + 2 &
\end{aligned}$$

Example 2

Q. Solve for x: $\frac{2}{3x+1} + \frac{3}{x-1} = \frac{5}{2}$.

Answer:

$$\begin{aligned}
\frac{2}{3x+1} + \frac{3}{x-1} &= \frac{5}{2} \\
\frac{2(3x+1)(x-1)(2)}{3x+1} + \frac{3(3x+1)(x-1)(2)}{x-1} &= \frac{5(3x+1)(x-1)(2)}{2} \\
2(x-1)(2) + 3(3x+1)(2) &= 5(3x+1)(x-1) \\
4(x-1) + 6(3x+1) &= (15x+5)(x-1) \\
4x - 4 + 18x + 6 &= 15x(x-1) + 5(x-1) \\
22x + 2 &= 15x^2 - 15x
\end{aligned}$$

Example 2

Q. Solve for x: $\frac{2}{3x+1} + \frac{3}{x-1} = \frac{5}{2}$.

Answer:

$$\begin{aligned}
\frac{2}{3x+1} + \frac{3}{x-1} &= \frac{5}{2} \\
\frac{2(3x+1)(x-1)(2)}{3x+1} + \frac{3(3x+1)(x-1)(2)}{x-1} &= \frac{5(3x+1)(x-1)(2)}{2} \\
2(x-1)(2) + 3(3x+1)(2) &= 5(3x+1)(x-1) \\
4(x-1) + 6(3x+1) &= (15x+5)(x-1) \\
4x - 4 + 18x + 6 &= 15x(x-1) + 5(x-1) \\
22x + 2 &= 15x^2 - 15x + 5x - 5
\end{aligned}$$

Example 2

Q. Solve for x: $\frac{2}{3x+1} + \frac{3}{x-1} = \frac{5}{2}$.

Answer:

$$\begin{aligned}
\frac{2}{3x+1} + \frac{3}{x-1} &= \frac{5}{2} \\
\frac{2(3x+1)(x-1)(2)}{3x+1} + \frac{3(3x+1)(x-1)(2)}{x-1} &= \frac{5(3x+1)(x-1)(2)}{2} \\
2(x-1)(2) + 3(3x+1)(2) &= 5(3x+1)(x-1) \\
4(x-1) + 6(3x+1) &= (15x+5)(x-1) \\
4x - 4 + 18x + 6 &= 15x(x-1) + 5(x-1) \\
22x + 2 &= 15x^2 - 15x + 5x - 5 \\
22x + 2 &= 15x^2 - 10x - 5
\end{aligned}$$

Example 2

$$22x + 2 = 15x^2 - 10x - 5$$

Example 2

$$\begin{aligned} 22x + 2 &= 15x^2 - 10x - 5 \\ 22x + 2 - 15x^2 + 10x + 5 &= 0 \end{aligned}$$

Example 2

$$\begin{aligned} 22x + 2 &= 15x^2 - 10x - 5 \\ 22x + 2 - 15x^2 + 10x + 5 &= 0 \\ -15x^2 + 32x + 7 &= 0 \end{aligned}$$

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$$\begin{aligned} 22x + 2 &= 15x^2 - 10x - 5 \\ 22x + 2 - 15x^2 + 10x + 5 &= 0 \\ -15x^2 + 32x + 7 &= 0 \end{aligned}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Example 2

$$\begin{aligned} 22x + 2 &= 15x^2 - 10x - 5 \\ 22x + 2 - 15x^2 + 10x + 5 &= 0 \\ -15x^2 + 32x + 7 &= 0 \end{aligned}$$

$$\begin{aligned} x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-32 \pm \sqrt{32^2 - 4(-15)(7)}}{2(-15)} \end{aligned}$$

Example 2

$$\begin{aligned} 22x + 2 &= 15x^2 - 10x - 5 \\ 22x + 2 - 15x^2 + 10x + 5 &= 0 \\ -15x^2 + 32x + 7 &= 0 \end{aligned}$$

$$\begin{aligned} x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-32 \pm \sqrt{32^2 - 4(-15)(7)}}{2(-15)} \\ &= \frac{-32 \pm \sqrt{1024 + 420}}{-30} \end{aligned}$$

Example 2

$$\begin{aligned} 22x + 2 &= 15x^2 - 10x - 5 \\ 22x + 2 - 15x^2 + 10x + 5 &= 0 \\ -15x^2 + 32x + 7 &= 0 \end{aligned}$$

$$\begin{aligned} x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-32 \pm \sqrt{32^2 - 4(-15)(7)}}{2(-15)} \\ &= \frac{-32 \pm \sqrt{1024 + 420}}{-30} \\ &= \frac{-32 \pm \sqrt{1444}}{-30} \end{aligned}$$

Example 2

$$x = \frac{-32 \pm \sqrt{1444}}{-30}$$

Example 2

$$\begin{aligned} x &= \frac{-32 \pm \sqrt{1444}}{-30} \\ &= \frac{-32 \pm 38}{-30} \end{aligned}$$

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$$\begin{aligned} x &= \frac{-32 \pm \sqrt{1444}}{-30} \\ &= \frac{-32 \pm 38}{-30} \\ &= \frac{-16 \pm 19}{-15} \end{aligned}$$

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$$x = \frac{-16 + 19}{-15}$$

Example 2

$$\begin{aligned} x &= \frac{-32 \pm \sqrt{1444}}{-30} \\ &= \frac{-32 \pm 38}{-30} \\ &= \frac{-16 \pm 19}{-15} \end{aligned}$$

$$\begin{aligned} x &= \frac{-16 + 19}{-15} \\ &= \frac{3}{-15} \end{aligned}$$

Example 2

$$\begin{aligned} x &= \frac{-32 \pm \sqrt{1444}}{-30} \\ &= \frac{-32 \pm 38}{-30} \\ &= \frac{-16 \pm 19}{-15} \end{aligned}$$

$$\begin{aligned} x &= \frac{-16 + 19}{-15} \\ &= \frac{3}{-15} \\ &= -\frac{1}{5} \end{aligned}$$

Example 2

$$\begin{aligned} x &= \frac{-32 \pm \sqrt{1444}}{-30} \\ &= \frac{-32 \pm 38}{-30} \\ &= \frac{-16 \pm 19}{-15} \end{aligned}$$

$$\begin{aligned} x &= \frac{-16 + 19}{-15} \\ &= \frac{3}{-15} \\ &= -\frac{1}{5} \end{aligned}$$

$$x = \frac{-16 - 19}{-15}$$

Example 2

$$\begin{aligned} x &= \frac{-32 \pm \sqrt{1444}}{-30} \\ &= \frac{-32 \pm 38}{-30} \\ &= \frac{-16 \pm 19}{-15} \end{aligned}$$

$$\begin{aligned} x &= \frac{-16 + 19}{-15} \\ &= \frac{3}{-15} \\ &= -\frac{1}{5} \end{aligned}$$

$$\begin{aligned} x &= \frac{-16 - 19}{-15} \\ &= \frac{-35}{-15} \end{aligned}$$

Example 2

$$\begin{aligned} x &= \frac{-32 \pm \sqrt{1444}}{-30} \\ &= \frac{-32 \pm 38}{-30} \\ &= \frac{-16 \pm 19}{-15} \end{aligned}$$

$$\begin{aligned} x &= \frac{-16 + 19}{-15} \\ &= \frac{3}{-15} \\ &= -\frac{1}{5} \end{aligned}$$

$$\begin{aligned} x &= \frac{-16 - 19}{-15} \\ &= \frac{-35}{-15} \\ &= \frac{7}{3} \end{aligned}$$

Example 2

$$\begin{aligned} x &= \frac{-32 \pm \sqrt{1444}}{-30} \\ &= \frac{-32 \pm 38}{-30} \\ &= \frac{-16 \pm 19}{-15} \end{aligned}$$

$$\begin{aligned} x &= \frac{-16+19}{-15} \\ &= \frac{3}{-15} \\ &= -\frac{1}{5} \end{aligned} \qquad \begin{aligned} x &= \frac{-16-19}{-15} \\ &= \frac{-35}{-15} \\ &= \frac{7}{3} \end{aligned}$$

$$\therefore \quad x = -\frac{1}{5}, \frac{7}{3}$$