

Solve each equation. Check for extraneous solutions.

1.
$$2a \left(\frac{a+4}{2a} + 2 = \frac{3}{2} \right) = \frac{2a(a+4)}{2a} + \frac{2a \cdot 2}{1} = \frac{2a \cdot 3}{2}$$

$a \neq 0$

$$\begin{aligned} a+4+4a &= 3a \\ 5a+4 &= 3a \\ -5a & \quad -5a \\ \hline 4 &= -2a \\ -2 & \quad -2 \\ \hline -2 &= a \end{aligned}$$

$a = -2$

2.
$$m^2 \left(\frac{3m+15}{m^2} - \frac{1}{m} = \frac{1}{1} \right) = \frac{m^2(3m+15)}{m^2} - \frac{m^2 \cdot 1}{m} = \frac{1 \cdot m^2}{1}$$

$m \neq 0$

$$\begin{aligned} 3m+15-m &= m^2 \\ 2m+15 &= m^2 \\ -2m & \quad -2m \\ \hline 15 &= m^2-2m \\ -15 & \quad -15 \\ \hline 0 &= m^2-2m-15 \\ &= (m-5)(m+3) \end{aligned}$$

$x = 5, -3$

3.
$$(3x-5)8 = \frac{1+2x}{3x-5} (3x-5)$$

$x \neq \frac{5}{3}$

$$\begin{aligned} 24x-40 &= 1+2x \\ -2x & \quad -2x \\ \hline 22x-40 &= 1 \\ +40 & \quad +40 \\ \hline 22x &= 41 \\ x &= \frac{41}{22} \end{aligned}$$

$x = \frac{41}{22}$

4.
$$6(y+1) \left(\frac{4}{3} - \frac{y}{y+1} = \frac{1}{2} \right) = \frac{6(y+1)4}{3} - \frac{6(y+1)y}{y+1} = \frac{36(y+1) \cdot 1}{2}$$

$y \neq -1$

$$\begin{aligned} 8(y+1) - 6y &= 3(y+1) \\ 8y+8-6y &= 3y+3 \\ 2y+8 &= 3y+3 \\ -2y-3 & \quad -2y-3 \\ \hline 5 &= y \end{aligned}$$

$5 = y$

5.
$$4(d+2) \left(\frac{-3d}{4d+8} + 2 = \frac{5}{d+2} \right) = \frac{4(d+2)(-3d)}{4(d+2)} + \frac{4(d+2)2}{1} = \frac{4(d+2)5}{d+2}$$

$d \neq -2$

$$\begin{aligned} -3d + 8(d+2) &= 20 \\ -3d + 8d + 16 &= 20 \\ 5d + 16 &= 20 \\ -16 & \quad -16 \\ \hline 5d &= 4 \\ \frac{5}{5} & \quad \frac{5}{5} \\ \hline d &= \frac{4}{5} \end{aligned}$$

$d = \frac{4}{5}$

6.
$$\frac{-4}{n-2} = \frac{n}{3n-6} \quad n \neq 2$$

$$\begin{aligned} n(n-2) &= -4(3n-6) \\ n^2-2n &= -12n+24 \\ +12n & \quad +12n \\ \hline n^2+10n &= 24 \\ -24 & \quad -24 \\ \hline n^2+10n-24 &= 0 \\ (n+12)(n-2) &= 0 \end{aligned}$$

$n = -12, 2$ (Extraneous!)

7.
$$(r+2)(r+4) \left(\frac{1}{r+2} + \frac{r-1}{r^2+6r+8} = \frac{1}{r+4} \right) = \frac{(r+2)(r+4) \cdot 1}{r+2} + \frac{(r+2)(r+4)(r-1)}{(r+2)(r+4)} = \frac{(r+2)(r+4) \cdot 1}{r+4}$$

$r \neq -2, -4$

$$\begin{aligned} r+4 + r-1 &= r+2 \\ 2r+3 &= r+2 \\ -r-3 & \quad -r-3 \\ \hline r &= -1 \end{aligned}$$

$r = -1$

8.
$$5(w-3)(w-1) \left(\frac{1}{5w-5} = \frac{1}{w-3} + \frac{w+2}{5w^2-20w+15} \right) = \frac{5(w-3)(w-1) \cdot 1}{5(w-1)} = \frac{5(w-3)(w-1) \cdot 1}{w-3} + \frac{5(w-3)(w-1)(w+2)}{5(w-3)(w-1)}$$

$w-3 = 5(w-1) + w+2$
 $w-3 = 5w-5+w+2$
 $w-3 = 6w-3$

$$\begin{array}{r} -w+3 \\ -w+3 \\ \hline 0 \end{array}$$

$0 = \frac{5w}{5}$
 $0 = w$

$w \neq 1, 3$

9.
$$2k^2 \left(\frac{1}{k^2} + \frac{k+3}{2k} = \frac{1}{2} \right) = \frac{2k^2 \cdot 1}{k^2} + \frac{2k^2(k+3)}{2k} = \frac{2k^2 \cdot 1}{2}$$

$2 + k(k+3) = k^2$
 $2 + k^2 + 3k = k^2$

$$\begin{array}{r} -k^2 \\ -k^2 \\ \hline 2 + 3k = 0 \\ -2 \end{array}$$

$3k = -2$
 $\frac{3k}{3} = \frac{-2}{3}$
 $k = -\frac{2}{3}$

$k \neq 0$

10.
$$h(h-3)(h-3) \left(\frac{9}{h^2-6h+9} = \frac{3h}{h^2-3h} \right) = \frac{h(h-3)(h-3) \cdot 9}{(h-3)(h-3)} = \frac{h(h-3)(h-3) \cdot 3h}{h(h-3)}$$

$9h = h(h-3) \cdot 3$
 $9h = (h^2-3h) \cdot 3$
 $9h = 3h^2 - 9h$

$$\begin{array}{r} -9h \\ -9h \\ \hline 0 = 3h^2 - 18h \\ 0 = 3h(h-6) \\ h = 0, 6 \end{array}$$

$h \neq 0, 3$

extraneous

ERROR ANALYSIS Describe and correct the error.

11.
$$\frac{3}{x^2} + \frac{5}{2x} = \frac{1}{2}$$

$6x + 5x = x^2$
 $11x = x^2$
 $0 = x^2 - 11x$
 $0 = x(x-11)$
 $x = 0, 11$
 $x \neq 0$ because it extraneous

X

Messed up common denominator

$$2x^2 \left(\frac{3}{x^2} + \frac{5}{2x} = \frac{1}{2} \right) = \frac{2x^2 \cdot 3}{x^2} + \frac{2x^2 \cdot 5}{2x} = \frac{2x^2 \cdot 1}{2}$$

$x \neq 0$

$6 + 5x = x^2$

$$\begin{array}{r} -6 \\ -6 \\ \hline 0 = x^2 - 5x - 6 \\ 0 = (x-6)(x+1) \\ x = 6, -1 \end{array}$$