

Honors Math 3 - Solving Rational Eqns

$$\textcircled{1} \frac{2w+10}{w^2-25} = \frac{15-3w}{5w-w^2} \quad \frac{2(w+5)}{(w+5)(w-5)} = \frac{3(5-w)}{w(5-w)}$$

$$\frac{2}{w-5} = \frac{3}{w}$$

$$2w = 3w - 15$$
$$-w = -15$$

$$w = 15$$

$$\textcircled{2} \frac{3g+6}{g^2-4} = \frac{5g+25}{g^2+5g} \quad \frac{3(g+2)}{(g+2)(g-2)} = \frac{5(g+5)}{g(g+5)}$$

$$\frac{3}{g-2} = \frac{5}{g}$$

$$3g = 5g - 10$$

$$-2g = -10$$

$$g = 5$$

$$\textcircled{3} \frac{m-1}{5} = \frac{5}{m-1}$$

$$(m-1)(m-1) = 25$$
$$m^2 - 2m + 1 = 25$$

$$m^2 - 2m - 24 = 0$$

$$(m-6)(m+4) = 0$$

$$m = 6$$

$$m = -4$$

$$\textcircled{4} \frac{v-10}{16} - \frac{-2}{v+8} = 0 \quad \frac{v-10}{16} = \frac{-2}{v+8}$$

$$(v-10)(v+8) = -32$$

$$v^2 - 2v - 80 = -32$$

$$v^2 - 2v - 48 = 0$$

$$(v-8)(v+6) = 0$$

$$v = 8$$

$$v = -6$$

$$\textcircled{5} \frac{a}{2a+1} + \frac{1}{4a+3} = 0$$

$$\frac{a}{2a+1} = \frac{-1}{4a+3}$$

$$4a^2 + 3a = -2a - 1$$

$$4a^2 + 5a + 1 = 0$$

$$(4a^2 + 4a) + (a + 1) = 0$$

$$4a(a+1) + 1(a+1) = 0$$

$$(4a+1)(a+1) = 0$$

$$\boxed{a = -1}$$

$$a = -\frac{1}{4}$$

$$\textcircled{6} \frac{n+4}{n-2} = \frac{9}{n^2+2n-8}$$

$$9n-18 = (n+4)(n^2+2n-8)$$

$$9n-18 = n^3 + 2n^2 - 8n + 4n^2 + 8n - 32$$

$$9n-18 = n^3 + 6n^2 - 32$$

$$0 = n^3 + 6n^2 - 9n - 14$$

* Graph in calc!

in calc table \Rightarrow $\boxed{x = -7, x = -1, x = 2}$ \leftarrow makes denom = 0

$$\textcircled{7} \frac{2y}{y-2} = \frac{10}{y^2 - 6y + 8}$$

$$2y^3 - 12y^2 + 16y = 10y - 20$$

$$* 2y^3 - 12y^2 + 6y + 20 = 0$$

can \div by 2

$$y^3 - 6y^2 + 3y + 10 = 0$$

* Graph in calc!

$$\boxed{x = -1, x = 5, x = 2}$$

\uparrow makes denom = 0

$$\textcircled{8} r-5 = \frac{14}{r}$$

$$r^2 - 5r = 14$$

$$r^2 - 5r - 14 = 0$$

$$(r-7)(r+2) = 0$$

$$\boxed{r = 7 \quad r = -2}$$

$$\textcircled{1} \quad y+5 = \frac{6}{2-y}$$

$$(y+5)(2-y) = 6$$

$$2y - y^2 + 10 - 5y = 6$$

$$-y^2 - 3y + 10 = 6$$

$$-y^2 - 3y + 4 = 0 \quad \div \text{ by } -1$$

$$y^2 + 3y - 4 = 0$$

$$(y+4)(y-1) = 0$$

$$\boxed{y = -4 \quad y = 1}$$

$$\textcircled{10} \quad 4n-3 = \frac{n+13}{n+1}$$

$$(4n-3)(n+1) = n+13$$

$$4n^2 + 4n - 3n - 3 = n + 13$$

$$4n^2 + n - 3 = n + 13$$

$$4n^2 - 3 = 13$$

$$4n^2 = 16$$

$$n^2 = 4$$

$$\boxed{n = \pm 2}$$

$$\textcircled{11} \quad y+5 + \frac{6}{y-2} = 0$$

$$y+5 = \frac{-6}{y-2}$$

$$(y+5)(y-2) = -6$$

$$y^2 - 2y + 5y - 10 = -6$$

$$y^2 + 3y - 10 = -6$$

$$y^2 + 3y - 4 = 0$$

$$(y+4)(y-1) = 0$$

$$\boxed{y = -4 \quad y = 1}$$

$$\textcircled{12} \quad 5 = \frac{x+5}{x-2} - x$$

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

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

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

$$x^2 + 3x - 10 = x + 5$$

$$x^2 + 2x - 15 = 0$$

$$(x+5)(x-3) = 0$$

$$x = -5$$

$$x = 3$$

$$\textcircled{13} \quad 14 = \frac{k-14}{k-1} + 4k$$

$$(14-4k)(k-1) = k-14$$

$$14k - 14 - 4k^2 + 4k = k - 14$$

$$-4k^2 + 18k - 14 = k - 14$$

$$-4k^2 + 17k = 0$$

$$-k(4k-17) = 0$$

$$-k = 0 \quad 4k - 17 = 0$$

$$k = 0$$

$$k = \frac{17}{4}$$

$$\textcircled{14} \quad \frac{3y^2+2}{5} + 1 = \frac{y+3}{2}$$

$$\frac{3y^2+2}{5} + \frac{5}{5} = \frac{y+3}{2}$$

$$\frac{3y^2+7}{5} = \frac{y+3}{2}$$

$$6y^2 + 14 = 5y + 15$$

$$6y^2 - 5y - 1 = 0$$

$$(6y+1)(y-1) = 0$$

$$6y+1=0 \quad y-1=0$$

$$y = -\frac{1}{6}$$

$$y = 1$$

$$\textcircled{16} \quad \frac{1}{x} = \frac{1}{3} + \frac{2}{3x^2}$$

$$\underline{\text{CD}}: 3x^2$$

$$\frac{3x}{3x^2} = \frac{x^2}{3x^2} + \frac{2}{3x^2}$$

$$3x = x^2 + 2$$

$$0 = x^2 - 3x + 2$$

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

$$\boxed{\begin{array}{l} x=2 \\ x=1 \end{array}}$$

$$\textcircled{17} \quad \frac{6}{r-2} + 4 = \frac{3r}{r-2}$$

$$\underline{\text{CD}}: (r-2)$$

$$\frac{6}{r-2} + \frac{4(r-2)}{r-2} = \frac{3r}{r-2}$$

$$6 + 4r - 8 = 3r$$

$$4r - 2 = 3r$$

$$-2 = -r$$

~~r=2~~ makes
denom = 0

$$\boxed{\emptyset}$$

$$\textcircled{18} \quad \frac{2x+1}{x} = \frac{x}{x+2} + 2$$

$$\underline{\text{CD}}: x(x+2)$$

$$\frac{(2x+1)(x+2)}{x(x+2)} = \frac{x^2}{x(x+2)} + \frac{2x(x+2)}{x(x+2)}$$

$$2x^2 + 4x + x + 2 = x^2 + 2x^2 + 4x$$

$$2x^2 + 5x + 2 = 3x^2 + 4x$$

$$0 = x^2 - x - 2$$

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

$$\boxed{\begin{array}{l} x=2 \\ x=-1 \end{array}}$$

$$(11) \frac{n-4}{n^2+2n} - \frac{1}{n} = 6 \quad \frac{n-4}{n(n+2)} - \frac{1}{n} = 6 \quad \text{CD: } n(n+2)$$

$$\frac{n-4}{n(n+2)} - \frac{n+2}{n(n+2)} = \frac{6(n+2)}{n(n+2)}$$

$$n-4 - n-2 = 6n^2 + 12n$$

$$-6 = 6n^2 + 12n$$

$$0 = 6n^2 + 12n + 6$$

$$0 = 6(n^2 + 2n + 1)$$

$$0 = 6(n+1)(n+1)$$

$$\boxed{n = -1}$$

~~$\frac{n-4}{n(n+2)}$~~ ~~$-\frac{n+2}{n(n+2)}$~~ ~~$= \frac{6(n+2)}{n(n+2)}$~~

(20) $\frac{4}{y-1} + 2 = \frac{4}{y^2-y}$ $\frac{4}{y-1} + \frac{2}{1} = \frac{4}{y(y-1)}$

CD: $y(y-1)$

$$\frac{4y}{y(y-1)} + \frac{2y(y-1)}{y(y-1)} = \frac{4}{y(y-1)}$$

$$4y + 2y^2 - 2y = 4$$

$$2y^2 + 2y = 4$$

$$2y^2 + 2y - 4 = 0$$

$$2(y^2 + y - 2) = 0$$

$$2(y+2)(y-1) = 0$$

$y = -2$

~~$y = 1$~~ makes
denom = 0

$$\textcircled{21} \quad \frac{7}{s-1} - \frac{10}{s^2-5} = \frac{s+2}{s}$$

$$\frac{7}{s-1} - \frac{10}{s(s-1)} = \frac{s+2}{s}$$

CD: $s(s+1)$

$$\frac{7s}{s(s+1)} - \frac{10}{s(s-1)} = \frac{(s+2)(s-1)}{s(s-1)}$$

$$7s-10 = s^2 + s - 2$$

$$0 = s^2 - 6s + 8$$

$$0 = (s-4)(s-2)$$

$$\boxed{s=4} \quad \boxed{s=2}$$

$$\textcircled{22} \quad \frac{2}{w^2-2w} - \frac{1}{3} = \frac{1}{w}$$

$$\frac{2}{w(w-2)} - \frac{1}{3} = \frac{1}{w} \quad \text{CD: } 3w(w-2)$$

$$\frac{6}{3w(w-2)} - \frac{w(w-2)}{3w(w-2)} = \frac{3(w-2)}{3w(w-2)}$$

$$6 - w^2 + 2w = 3w - 6$$

$$0 = w^2 + w - 12$$

$$0 = (w+4)(w-3)$$

$$\boxed{w=-4} \quad \boxed{w=3}$$

Q3

$$\frac{10x}{x+2} = \frac{2x^2-3}{x^2-4} + \frac{2x-3}{x-2}$$

$$\frac{10x}{(x+2)} = \frac{2x^2-3}{(x+2)(x-2)} + \frac{2x-3}{(x-2)}$$

CD: $(x+2)(x-2)$

$$\frac{10x(x-2)}{(x+2)(x-2)} = \frac{2x^2-3}{(x+2)(x-2)} + \frac{(2x-3)(x+2)}{(x+2)(x-2)}$$

$$10x^2 - 20x = 2x^2 - 3 + 2x^2 + 4x - 3x - 6$$

$$10x^2 - 20x = 4x^2 + x - 9$$

$$6x^2 - 21x + 9 = 0$$

$$3(2x^2 - 7x + 3) = 0$$

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

$$x = 3$$

$$x = \frac{1}{2}$$

$$\textcircled{24} \frac{y^2+1}{y^2-1} + \frac{y+3}{y-1} = \frac{y}{y+1}$$

$$\frac{y^2+1}{(y+1)(y-1)} + \frac{y+3}{y-1} = \frac{y}{y+1}$$

$$\frac{y^2+1}{(y-1)(y+1)} + \frac{(y+3)(y+1)}{(y-1)(y+1)} = \frac{y(y-1)}{(y-1)(y+1)}$$

$$\text{CD: } (y-1)(y+1)$$

$$y^2+1 + y^2+4y+3 = y^2-y$$

$$2y^2+4y+4 = y^2-y$$

$$y^2+5y+4=0$$

$$(y+4)(y+1)=0$$

$$y = -4$$

~~y = -1~~ ← makes denom = 0

$$\textcircled{25} \frac{2x-24}{x^2-8x+12} = \frac{3x}{x-6} + \frac{5}{x-2}$$

$$\frac{2x-24}{(x-6)(x-2)} = \frac{3x}{x-6} + \frac{5}{x-2}$$

$$\text{CD: } (x-6)(x-2)$$

$$\frac{2x-24}{(x-6)(x-2)} = \frac{3x(x-2)}{(x-6)(x-2)} + \frac{5(x-6)}{(x-6)(x-2)}$$

$$2x-24 = 3x^2-6x+5x-30$$

$$2x-24 = 3x^2-x-30$$

$$0 = 3x^2-3x-6$$

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

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

~~x = 2~~ ← makes denom = 0

$$x = -1$$

$$\textcircled{26} \frac{3f-5}{f^2+4f+3} + \frac{2f+2}{f+3} = \frac{f-3}{f+1} \quad \frac{3f-5}{(f+3)(f+1)} + \frac{2f+2}{(f+3)} = \frac{f-3}{(f+1)}$$

$\text{CD} : (f+3)(f+1)$

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

$$3f-5+2f^2+4f+2 = f^2-9$$

$$2f^2+7f-3 = f^2-9$$

$$f^2+7f+6=0$$

$$(f+6)(f+1)=0$$

$$f = -6$$

$$f = -1$$

\uparrow makes denom = 0

$$\textcircled{27} \frac{n+44}{2n^2+9n+10} + \frac{2}{2n+5} = \frac{3n}{n+2} \quad \frac{n+44}{(2n+5)(n+2)} + \frac{2}{(2n+5)} = \frac{3n}{(n+2)}$$

$$\text{CD} : (2n+5)(n+2)$$

$$\frac{n+44}{(2n+5)(n+2)} + \frac{2(n+2)}{(2n+5)(n+2)} = \frac{3n(2n+5)}{(2n+5)(n+2)}$$

$$n+44+2n+4 = 6n^2+15n$$

$$48+3n = 6n^2+15n$$

$$0 = 6n^2+12n-48$$

$$0 = 6(n^2+2n-8)$$

$$0 = 6(n+4)(n-2)$$

$$\boxed{\begin{matrix} n = -4 \\ n = 2 \end{matrix}}$$

$$\frac{2}{n^2+7n+12} - \frac{2-4n}{n+4} = \frac{2n}{n+3} \quad \frac{2}{(n+3)(n+4)} - \frac{2-4n}{(n+4)} = \frac{2n}{(n+3)}$$

$$\underline{CD}: (n+3)(n+4)$$

$$\frac{2}{(n+3)(n+4)} - \frac{(2-4n)(n+3)}{(n+3)(n+4)} = \frac{2n(n+4)}{(n+3)(n+4)}$$

$$2 - (2n+6-4n^2-12n) = 2n^2+8n$$

$$2 - (-4n^2-10n+6) = 2n^2+8n$$

$$2+4n^2+10n-6 = 2n^2+8n$$

$$2n^2+2n-4=0$$

$$2(n^2+n-2)=0$$

$$2(n+2)(n-1)=0$$

$$\begin{aligned} n &= -2 \\ n &= 1 \end{aligned}$$

29) $\frac{2y}{y^2+3y-10} + \frac{4}{y^2+6y+5} = \frac{3y}{y^2-y-2}$ $\frac{2y}{(y+5)(y-2)} + \frac{4}{(y+5)(y+1)} = \frac{3y}{(y-2)(y+1)}$

$$\underline{CD}: (y+5)(y-2)(y+1)$$

$$\frac{2y(y+1)}{(y+5)(y-2)(y+1)} + \frac{4(y-2)}{(y+5)(y-2)(y+1)} = \frac{3y(y+5)}{(y+5)(y-2)(y+1)}$$

$$2y^2+2y+4y-8 = 3y^2+15y$$

$$2y^2+6y-8 = 3y^2+15y$$

$$0 = y^2+9y+83$$

$$0 = (y+8)(y+1)$$

$$y = -8$$

~~$y = -1$~~
 makes denom. = 0

$$\frac{5}{x^2-x-6} + \frac{x}{x^2+5x+6} = \frac{2x}{x^2-9} \quad \frac{5}{(x-3)(x+2)} + \frac{x}{(x+3)(x+2)} = \frac{2x}{(x+3)(x-3)}$$

$$\underline{CD} : (x-3)(x+2)(x+3)$$

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

$$5x+15 + x^2-3x = 2x^2+4x$$

$$x^2+2x+15 = 2x^2+4x$$

$$0 = x^2+2x-15$$

$$0 = (x+5)(x-3)$$

$$x = -5$$

~~$$x = 3$$~~

↑ makes
denom = 0

$$\textcircled{3} \frac{4m}{m^2+5m+6} - \frac{3m}{m^2+6m+8} = \frac{6}{m^2+7m+12}$$

$$\frac{4m}{(m+3)(m+2)} - \frac{3m}{(m+4)(m+2)} = \frac{6}{(m+3)(m+4)}$$

$$\underline{CD} : (m+3)(m+2)(m+4)$$

$$\frac{4m(m+4)}{(m+3)(m+2)(m+4)} - \frac{3m(m+3)}{(m+3)(m+2)(m+4)} = \frac{6(m+2)}{(m+3)(m+2)(m+4)}$$

$$4m^2+16m-3m^2-9m = 6m+12$$

~~$$m^2+7m = 6m+12$$~~

$$m^2+m-12 = 0$$

$$(m+4)(m-3) = 0$$

~~$$m = 4$$~~

$$m = 3$$

makes
denom. = 0

$$(32) \frac{4a}{3a^2+20a+12} + \frac{5}{a^2+5a-6} = \frac{3a}{3a^2-a-2} \quad \frac{4a}{(3a+2)(a+6)} + \frac{5}{(a+6)(a-1)} = \frac{3a}{(3a+2)(a-1)}$$

$$\underline{CD} : (3a+2)(a+6)(a-1)$$

$$\frac{4a(a-1)}{(3a+2)(a+6)(a-1)} + \frac{5(3a+2)}{(3a+2)(a+6)(a-1)} = \frac{3a(a+6)}{(3a+2)(a+6)(a-1)}$$

$$4a^2 - 4a + 15a + 10 = 3a^2 + 18a$$

$$4a^2 + 11a + 10 = 3a^2 + 18a$$

$$a^2 - 7a + 10 = 0$$

$$(a-5)(a-2) = 0$$

$$a = 5$$

$$a = 2$$