

pg. 138 #21, 25, 33-41

21. zeros: none

$$4x^2 - 2x + 1 = 0$$

$$x = \frac{-2 \pm \sqrt{4 - 4(4)(1)}}{2(4)} = \frac{-2 \pm \sqrt{-12}}{8} \quad \text{no real zeros}$$

VA: $x = \sqrt[3]{-4/3}$

$$3x^3 + 4 = 0$$

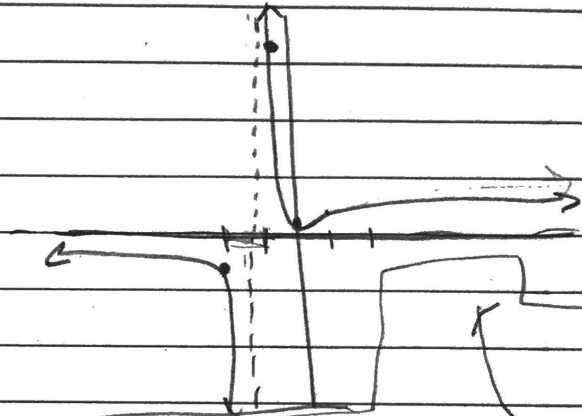
$$3x^3 = -4$$

$$x^3 = -\frac{4}{3}$$

$$x = \sqrt[3]{-4/3} = -1.10$$

HA: $y = 0$

holes: none



x	y
-2	-1.05
-1	7
0	0.25
1	0.478
2	0.46

25. zeros: $x=0, x=-2, x=-1$

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

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

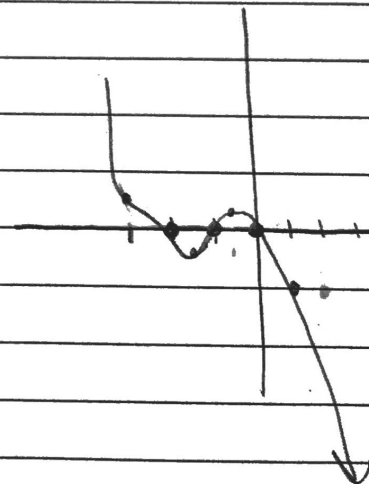
$$x(x+2)(x+1) = 0$$

VA: $x-4=0$

$$x=4$$

HA: none

holes: none



x	y
-3	0.857
-1.5	-0.0682
-0.5	0.0833
1	-2
5	210
6	168

33. $(\frac{8}{z} - z) = 4(z)$

$$8 - z^2 = 4z$$

$$0 = z^2 + 4z - 8$$

$$z = \frac{-4 \pm \sqrt{16 - 4(1)(-8)}}{2(1)}$$

$$z = \frac{-4 \pm \sqrt{48}}{2}$$

$$z = \frac{-4 \pm 4\sqrt{3}}{2} = -2 \pm 2\sqrt{3}$$

16
32
48

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

$$\frac{3x^2-3x}{3x(2x-4)} + \frac{2x^2-4x-8}{3x(2x-4)} = \frac{3x(2x-4)}{3x(2x-4)}$$

$$3x^2-3x+2x^2-4x-8 = 6x^2-12x$$

$$5x^2-7x-8 = 6x^2-12x$$

$$0 = x^2-5x-8$$

$$x = \frac{5 \pm \sqrt{25-4(1)(-8)}}{2(1)}$$

$$x = \frac{5 \pm \sqrt{57}}{2}$$

37
25
51

$$35. \frac{2}{y+2} - \frac{y}{2-y} = \frac{y^2+4}{y^2-4}$$

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

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

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

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

$$4y = 8$$

~~y=2~~ ← makes the denominator = 0

no solution

$$36. \frac{3}{x} + \frac{2}{x+1} = \frac{23}{x^2+x}$$

$$\frac{3x+3}{x(x+1)} + \frac{2x}{x(x+1)} = \frac{23}{x(x+1)}$$

$$3x+3+2x = 23$$

$$5x+3 = 23$$

$$5x = 20$$

$$x = 4$$

$$37. \frac{4}{x-2} - \frac{2 \cdot \frac{x-2}{x}}{x^2-2x}$$

$$\frac{4x}{x(x-2)} - \frac{2x-4}{x(x-2)} = \frac{14}{x(x-2)}$$

$$4x - 2x + 4 = 14$$

$$2x + 4 = 14$$

$$2x = 10$$

$$x = 5$$

$$38. \frac{x \cdot 20}{x+1} - \frac{x-1}{x} \cdot \frac{x+1}{x+1} \cdot \frac{20}{20} \cdot \frac{1}{x(x+1)}$$

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

$$20x - 20x^2 + 20 = x^2 + x$$

$$20x - 20x^2 + 20 = x^2 + x$$

$$0 = 21x^2 - 19x - 20$$

$$19 \pm \sqrt{361 - 4(21)(-20)}$$

$$x = \frac{2(21)}$$

$$x = \frac{19 \pm \sqrt{2041}}{42}$$

$$39. \frac{x+2}{x^2-3} - \frac{4}{x+2} \cdot \frac{x-3}{x^2-x-6} \cdot \frac{12}{12}$$

$$\frac{6x+12}{(x+2)(x-3)} - \frac{4x-12}{(x-3)(x+2)} = \frac{12}{(x-3)(x+2)}$$

$$6x+12-4x+12=12$$

$$2x+24=12$$

$$2x = -12$$

$$x = -6$$

$$40. \frac{x-1}{2x+1} + \frac{3x+6}{2x+1} \cdot \frac{x-2}{x-2} = 3 \cdot \frac{(x-2)(2x+1)}{(x-2)(2x+1)}$$

$$\frac{2x^2-x-1}{(2x+1)(x-2)} + \frac{3x^2-12}{(x-2)(2x+1)} = \frac{3(2x^2-3x-2)}{(x-2)(2x+1)}$$

$$2x^2-x-1+3x^2-12=6x^2-9x-6$$

$$5x^2-x-13=6x^2-9x-6$$

$$0 = x^2 - 8x + 7$$

$$0 = (x-7)(x-1)$$

$$x = 7$$

$$x = 1$$

$$41. \frac{2}{a+3} - \frac{3}{4-a} = \frac{2a-2}{a^2-a-12}$$

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

$$\frac{2a-8}{(a-4)(a+3)} + \frac{3a+9}{(a-4)(a+3)} = \frac{2a-2}{(a-4)(a+3)}$$

$$2a-8+3a+9=2a-2$$

$$5a+1=2a-2$$

$$3a=-3$$

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