

Quadratic Equations
Exercise 4.3

Q-1 $(x-4)(x+2) = 0$

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

$x = 4$

$x = -2$

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

$2x+3 = 0$

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

$3x-7 = 0$

$x = \frac{7}{3}$

Q-3 $3x^2 - 14x - 5 = 0$

$3x^2 - 15x + x - 5 = 0$

$3x(x-5) + 1(x-5) = 0$

$(x-5)(3x+1) = 0$

$x-5 = 0$

$x = 5$

$3x+1 = 0$

$x = \frac{-1}{3}$

Q-4 $9x^2 - 3x - 2 = 0$

$9x^2 - 6x + 3x - 2 = 0$

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

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

$3x-2 = 0$

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

$3x+1 = 0$

$x = \frac{-1}{3}$

Q.5

$$\frac{1}{x-1} - \frac{1}{x+5} = \frac{6}{7}$$

$$\frac{x+5 - x+1}{(x-1)(x+5)} = \frac{6}{7}$$

$$\frac{6}{x^2+5x-x-5} = \frac{6}{7}$$

$$\cancel{6}(7) = \cancel{6}(x^2+4x-5)$$

$$x^2+4x-5-7=0$$

$$x^2+4x-12=0$$

$$x^2+6x-2x-12=0$$

$$x(x+6)-2(x+6)=0$$

$$(x+6)(x-2)=0$$

$$x+6=0$$

$$x = -6$$

$$x-2=0$$

$$x = 2$$

Q.6

$$6x^2+11x+3=0$$

$$6x^2+9x+2x+3=0$$

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

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

$$2x+3=0$$

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

$$3x+1=0$$

$$x = \frac{-1}{3}$$

Q.7

$$5x^2-3x-2=0$$

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

$$5x(x-1)+2(x-1)=0$$

$$(x-1)(5x+2)=0$$

$$x-1=0$$

$$x = 1$$

$$5x+2=0$$

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

Q.8 $48x^2 - 13x - 1 = 0$
 $48x^2 - 16x + 3x - 1 = 0$
 $16x(3x-1) + 1(3x-1) = 0$
 $(3x-1)(16x+1) = 0$

$3x - 1 = 0$

$$\boxed{x = \frac{1}{3}}$$

$16x + 1 = 0$

$$\boxed{x = -\frac{1}{16}}$$

Q.9 $3x^2 = -11x - 10$

$3x^2 + 11x + 10 = 0$

$3x^2 + 6x + 5x + 10 = 0$

$3x(x+2) + 5(x+2) = 0$

$(x+2)(3x+5) = 0$

$x + 2 = 0$

$$\boxed{x = -2}$$

$3x + 5 = 0$

$$\boxed{x = -\frac{5}{3}}$$

Q.10 $25x(x+1) = -4$

$25x^2 + 25x + 4 = 0$

$25x^2 + 20x + 5x + 4 = 0$

$5x(5x+4) + 1(5x+4) = 0$

$(5x+4)(5x+1) = 0$

$5x + 4 = 0$

$$\boxed{x = -\frac{4}{5}}$$

$5x + 1 = 0$

$$\boxed{x = -\frac{1}{5}}$$

Q.11 $16x - \frac{10}{x} = 27$

$$16x^2 - 10 = 27x$$

$$16x^2 - 27x - 10 = 0$$

$$16x^2 - 32x + 5x - 10 = 0$$

$$16x(x-2) + 5(x-2) = 0$$

$$(x-2)(16x+5) = 0$$

$$x-2 = 0$$

$$\boxed{x = 2}$$

$$16x+5 = 0$$

$$x = \frac{-5}{16}$$

$$16$$

Q.15

$$\frac{1}{x-3} + \frac{2}{x-2} = \frac{8}{x}$$

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

$$\frac{x-2+2x-6}{x^2-2x-3x+6} = \frac{8}{x}$$

$$\frac{3x-8}{x^2-5x+6} = \frac{8}{x}$$

$$3x^2 - 8x = 8x^2 - 40x + 48$$

$$8x^2 - 3x^2 - 40x + 8x + 48 = 0$$

$$5x^2 - 32x + 48 = 0$$

$$5x^2 - 20x - 12x + 48 = 0$$

$$5x(x-4) - 12(x-4) = 0$$

$$(x-4)(5x-12) = 0$$

$$x-4 = 0$$

$$\boxed{x = 4}$$

$$5x-12 = 0$$

$$x = \frac{12}{5}$$

$$5$$

Q.16

$$a^2x^2 - 3abx + 2b^2 = 0$$

$$a^2x^2 - abx - 2abx + 2b^2 = 0$$

$$ax(ax - b) - 2b(ax - b) = 0$$

$$(ax - b)(ax - 2b) = 0$$

$$ax - b = 0$$

$$\boxed{x = \frac{b}{a}}$$

$$ax - 2b = 0$$

$$\boxed{x = \frac{2b}{a}}$$

~~$$q.17 \quad 9x^2 - 6b^2x - (a^4 - b^4) = 0$$~~

~~$$9x^2 - 6b^2x - (a^2 - b^2)(a^2 + b^2) = 0$$~~

$$q.17 \quad 9x^2 - 6b^2x - (a^4 - b^4) = 0$$

~~$$(3x)^2 - (a^2 - b^2)^2 - (2 \times 3x \times b^2)$$~~

$$(3x)^2 - a^4 + b^4 - 6b^2x = 0$$

$$(3x)^2 + (b^2)^2 - (2 \times 3x \times b^2) - a^4 = 0$$

~~$$3x + b^2$$~~
$$(3x - b^2)^2 - (a^2)^2 = 0$$

$$(3x - b^2 - a^2)(3x - b^2 + a^2) = 0$$

$$3x - b^2 - a^2 = 0$$

$$\boxed{x = \frac{a^2 + b^2}{3}}$$

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

$$\boxed{x = \frac{b^2 - a^2}{3}}$$

27/07/2020

classmate

Date

Page

Ch-4 Quadratic Equations - Exercise 4.3

Q.18 $4x^2 + 4bx - (a^2 - b^2) = 0$
 $\Rightarrow (2x)^2 + 4bx - a^2 + b^2 = 0$
 $\Rightarrow (2x)^2 + (b)^2 + (2 \times 2x \times b) - a^2 = 0$
 $\Rightarrow (2x + b)^2 - a^2 = 0$
 $\Rightarrow (2x + b - a)(2x + b + a) = 0$

$$2x + b - a = 0$$

$$\boxed{x = \frac{a - b}{2}}$$

$$2x + b + a = 0$$

$$\boxed{x = \frac{-a - b}{2}}$$

Q.19 $ax^2 + (4a^2 - 3b)x - 12ab = 0$
 $ax^2 + 4a^2x - 3bx - 12ab = 0$
 $ax(x + 4a) - 3b(x + 4a) = 0$
 $(x + 4a)(ax - 3b) = 0$

$$x + 4a = 0$$

$$\boxed{x = -4a}$$

$$ax - 3b = 0$$

$$\boxed{x = \frac{3b}{a}}$$

Q.20 $2x^2 + ax - a^2 = 0$
 $2x^2 + 2ax - ax - a^2 = 0$
 $2x(x + a) - a(x + a) = 0$
 $(x + a)(2x - a) = 0$

$$x + a = 0$$

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

$$2x - a = 0$$

$$\boxed{x = \frac{a}{2}}$$

$$Q.21) \frac{16}{x} - 1 = \frac{15}{x+1}$$

$$\frac{16-x}{x} = \frac{15}{x+1}$$

$$(16-x)(x+1) = 15x$$

$$16x + 16 - x^2 - x = 15x$$

$$-x^2 + 15x + 16 = 15x$$

$$x^2 - 16 = 0$$

$$x^2 - (4)^2 = 0$$

$$(x-4)(x+4) = 0$$

$$x-4=0$$

$$\boxed{x=4}$$

$$x+4=0$$

$$\boxed{x=-4}$$

$$Q.22) \frac{x+3}{x+2} = \frac{3x-7}{2x-3}$$

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

$$2x^2 - 3x + 6x - 9 = 3x^2 + 6x - 7x - 14$$

$$2x^2 + 3x - 9 = 3x^2 - x - 14$$

$$2x^2 - 3x^2 + 3x + x - 9 + 14 = 0$$

$$-x^2 + 4x + 5 = 0$$

$$x^2 - 4x - 5 = 0$$

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

$$x(x-5) + 1(x-5) = 0$$

$$(x-5)(x+1) = 0$$

$$x-5=0$$

$$\boxed{x=5}$$

$$x+1=0$$

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

$$Q.24) \frac{x+3}{x-2} - \frac{1-x}{x} = \frac{17}{4}$$

$$\frac{(x+3)(x) - (1-x)(x-2)}{(x-2)(x)} = \frac{17}{4}$$

$$\frac{x^2 + 3x - x + x^2 + 2 - 2x}{x^2 - 2x} = \frac{17}{4}$$

$$\frac{2x^2 + 2}{x^2 - 2x} = \frac{17}{4}$$

$$8x^2 + 8 = 17x^2 - 34x$$

$$8x^2 - 17x^2 = -34x - 8$$

$$9x^2 + 34x + 8 = 0$$

$$9x^2 - 36x + 2x + 8 = 0$$

$$9x(x-4) + 2(x-4) = 0$$

$$(x-4)(9x+2) = 0$$

$$x-4 = 0$$

$$\boxed{x=4}$$

$$9x+2=0$$

$$\boxed{x = \frac{-2}{9}}$$

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

$$5 + 5x - x - x^2 = 25 - x^2 + 5x - 5x$$

$$5 + 4x - x^2 = 25 - x^2 + 5x - 5x$$

$$0 = 20 - x + x^2 - x^2$$

$$0 = 20 - x + 0 - 0$$

$$0 = 20 - x$$

$$0 = 20 - x$$

$$0 = 20 - x$$

$$0 = 20 - x$$

$$0 = 20 - x$$

$$0 = 20 - x$$

$$0 = 20 - x$$

$$0 = 20 - x$$

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$$0 = 20 - x$$

$$0 = 20 - x$$

$$0 = 20 - x$$

ch-4

Exercise 4.3

Q-25

$$\frac{x-3}{x+3} - \frac{x+3}{x-3} = \frac{48}{7}$$

$$\frac{(x-3)^2 - (x+3)^2}{(x+3)(x-3)} = \frac{48}{7}$$

$$(x+3)(x-3)$$

$$\frac{(x^2 - 6x + 9) - (x^2 + 6x + 9)}{(x+3)(x-3)} = \frac{48}{7}$$

$$\frac{x^2 - 3x + 3x - 9}{(x+3)(x-3)}$$

$$\frac{x^2 - 6x + 9 - x^2 - 6x - 9}{(x+3)(x-3)} = \frac{48}{7}$$

$$\frac{x^2 - 9}{(x+3)(x-3)}$$

$$\frac{-12x}{x^2 - 9} = \frac{48}{7}$$

$$-84x = 48x^2 - 432$$

$$48x^2 + 84x - 432 = 0$$

$$4x^2 + 7x - 36 = 0$$

$$4x^2 + 16x - 9x - 36 = 0$$

$$4x(x+4) - 9(x+4) = 0$$

$$(x+4)(4x-9) = 0$$

$$x+4 = 0$$

$$\boxed{x = -4}$$

$$4x - 9 = 0$$

$$\boxed{x = \frac{9}{4}}$$

Q-26

$$\frac{1}{x-2} + \frac{2}{x-1} = \frac{6}{x}$$

$$\frac{(x-1) + 2(x-2)}{(x-2)(x-1)} = \frac{6}{x}$$

$$\frac{x-1+2x-4}{(x-2)(x-1)} = \frac{6}{x}$$

$$\frac{3x-5}{(x-2)(x-1)} = \frac{6}{x}$$

$$\frac{3x-5}{x^2-x-2x+2} = \frac{6}{x}$$

$$\frac{3x-5}{x^2-3x+2} = \frac{6}{x}$$

$$3x^2 - 5x = 6x^2 - 18x + 12$$

$$3x^2 - 5x + 18x - 12 = 6x^2$$

$$3x^2 - 6x^2 + 13x - 12 = 0$$

$$3x^2 - 13x + 12 = 0 \quad (3x-4)(x-3)$$

$$3x^2 - 9x - 4x + 12 = 0 \quad (3x-4)(x-3)$$

$$3x(x-3) - 4(x-3) = 0 \quad (3x-4)(x-3)$$

$$(x-3)(3x-4) = 0$$

$$x-3 = 0$$

$$\boxed{x=3}$$

$$3x-4 = 0$$

$$\boxed{x=\frac{4}{3}}$$

Q.29

$$\frac{4}{x} - 3 = \frac{5}{2x+3}$$

$$\frac{4-3x}{x} = \frac{5}{2x+3}$$

$$(4-3x)(2x+3) = 5x$$

$$8x + 12 - 6x^2 - 9x = 5x$$

$$-6x^2 - x + 12 = 0$$

$$-6x^2 - 6x + 12 = 0$$

$$6x^2 + 6x - 12 = 0$$

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

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

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

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

$$x+2 = 0$$

$$\boxed{x=-2}$$

$$x-1 = 0$$

$$\boxed{x=1}$$

Q.30

$$\frac{x-4}{x-5} + \frac{x-6}{x-7} = \frac{10}{3}$$

$$\frac{x-4}{x-5} + \frac{x-6}{x-7} = \frac{10}{3}$$

$$\frac{(x-4)(x-7) + (x-6)(x-5)}{(x-5)(x-7)} = \frac{10}{3}$$

$$\frac{x^2 - 7x - 4x + 28 + x^2 - 5x - 6x + 30}{x^2 - 7x - 5x + 35} = \frac{10}{3}$$

$$\frac{2x^2 - 22x + 58}{x^2 - 12x + 35} = \frac{10}{3}$$

$$\frac{2x^2 - 22x + 58}{x^2 - 12x + 35} = \frac{10}{3}$$

$$\frac{2x^2 - 22x + 58}{x^2 - 12x + 35} = \frac{10}{3}$$

$$6x^2 - 66x + 174 = 10x^2 - 120x + 350$$

$$6x^2 - 10x^2 - 66x + 120x + 174 - 350 = 0$$

$$-4x^2 + 54x - 176 = 0$$

$$4x^2 - 54x + 176 = 0$$

$$2x^2 - 27x + 88 = 0$$

$$2x^2 - 16x - 11x + 88 = 0$$

$$2x(x-8) - 11(x-8) = 0$$

$$(x-8)(2x-11) = 0$$

$$x-8 = 0$$

$$x = 8$$

$$2x-11 = 0$$

$$x = \frac{11}{2}$$

$$2$$

Q.31

$$\frac{x-2}{x-3} + \frac{x-4}{x-5} = \frac{10}{3}$$

$$\frac{x-2}{x-3} + \frac{x-4}{x-5} = \frac{10}{3}$$

$$\frac{(x-2)(x-5) + (x-4)(x-3)}{(x-3)(x-5)} = \frac{10}{3}$$

$$\frac{(x-2)(x-5) + (x-4)(x-3)}{(x-3)(x-5)} = \frac{10}{3}$$

$$\frac{x^2 - 5x - 2x + 10 + x^2 - 3x - 4x + 12}{x^2 - 5x - 3x + 15} = \frac{10}{3}$$

$$\frac{x^2 - 5x - 3x + 15}{x^2 - 5x - 3x + 15} = \frac{10}{3}$$

$$\frac{2x^2 - 14x + 22}{x^2 - 8x + 15} = \frac{10}{3}$$

$$\frac{2x^2 - 14x + 22}{x^2 - 8x + 15} = \frac{10}{3}$$

$$\frac{2x^2 - 14x + 22}{x^2 - 8x + 15} = \frac{10}{3}$$

$$\frac{2x^2 - 14x + 22}{x^2 - 8x + 15} = \frac{10}{3}$$

$$\begin{aligned} \cancel{3x^2 - 21x + 33} &= \cancel{10x^2 - 80x + 50} - x \\ \cancel{3x^2 - 10x^2 - 21x + 80x + 33 - 50} &= 0 \\ \cancel{-7x^2 + 59x - 17} &= 0 \\ \cancel{7x^2 - 59x + 17} &= 0 \end{aligned}$$

Q.32

$$\frac{5+x}{5-x} - \frac{5x}{5+x} = \frac{33}{4}$$

$$\frac{(5+x)^2 - (5-x)^2}{(5-x)(5+x)} = \frac{15}{4}$$

$$\frac{25+x^2+10x-25-x^2+10x}{25-x^2} = \frac{15}{4}$$

$$\frac{20x}{25-x^2} = \frac{15}{4}$$

$$80x = 375 - 15x^2$$

$$15x^2 + 80x - 375 = 0$$

$$3x^2 + 16x - 75 = 0$$

$$3x^2 + 25x - 9x - 75 = 0$$

$$3x(3x+25) - 9(3x+25) = 0$$

$$(3x+25)(x-3) = 0$$

$$3x+25=0$$

$$\boxed{x = -\frac{25}{3}}$$

$$x-3=0$$

$$\boxed{x = 3}$$

Q.31

$$\frac{x-2}{x-3} + \frac{x-4}{x-5} = \frac{10}{3}$$

$$\frac{(x-2)(x-5) + (x-4)(x-3)}{(x-3)(x-5)} = \frac{10}{3}$$

$$\frac{x^2 - 5x - 2x + 10 + x^2 - 3x - 4x + 12}{x^2 - 5x - 3x + 15} = \frac{10}{3}$$

$$\frac{2x^2 - 14x + 22}{x^2 - 8x + 15} = \frac{10}{3}$$

~~$$\frac{6x^2 - 42x + 66}{6x^2 - 10x^2 - 42x + 80x + 66 - 150} = 0$$~~

~~$$6x^2 - 10x^2 - 42x + 80x + 66 - 150 = 0$$~~

~~$$-4x^2 + 38x + 168 = 0$$~~

~~$$4x^2 - 38x + 16 = 0$$~~

~~$$2x^2 - 19x + 8 = 0$$~~

~~$$-4x^2 + 38x - 84 = 0$$~~

~~$$4x^2 - 38x + 84 = 0$$~~

~~$$2x^2 - 19x + 42 = 0$$~~

~~$$2x^2 - 12x - 7x + 42 = 0$$~~

~~$$2x(x-6) - 7(x-6) = 0$$~~

~~$$(x-6)(2x-7) = 0$$~~

$$x - 6 = 0$$

$$\boxed{x = 6}$$

$$2x - 7 = 0$$

$$\boxed{x = \frac{7}{2}}$$

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

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

~~$$\frac{6 - x - 1}{2x+2} = \frac{2}{3x+1}$$~~

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

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

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

~~$$-3x^2 + 14x - 4x + 5 - 4 = 0$$~~

~~$$-3x^2 + 10x - 1 = 0$$~~

~~$$3x^2 - 10x + 1 = 0$$~~

Q.33

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

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

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

$$\frac{9x-3-2x-2}{3x^2-x+3x-1} = \frac{1}{2}$$

$$\frac{7x-5}{3x^2+2x-1} = \frac{1}{2}$$

$$14x-10 = 3x^2+2x-1$$

$$3x^2+2x-14x-1+10=0$$

$$3x^2-12x+9=0$$

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

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

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

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

$$x-3=0$$

$$x=3$$

$$x-1=0$$

$$x=1$$

25/07/2020

classmate

Date

Page

$$(x-4)(x-4) = (x-4)(x-4)$$

Quadratic Equations

Exercise 4.3

Q.34

$$\frac{3}{x+1} + \frac{4}{x-1} = \frac{29}{4x-1}$$

$$\frac{3x-3+4x+4}{(x+1)(x-1)} = \frac{29}{4x-1}$$

$$\frac{7x+1}{x^2-1} = \frac{29}{4x-1}$$

$$(7x+1)(4x-1) = 29(x^2-1)$$

$$28x^2 - 7x + 4x - 1 = 29x^2 - 29$$

$$28x^2 - 29x^2 - 3x - 1 + 29 = 0$$

$$-x^2 - 3x + 28 = 0$$

$$x^2 + 3x - 28 = 0$$

$$x^2 + 7x - 4x - 28 = 0$$

$$x(x+7) - 4(x+7) = 0$$

$$(x+7)(x-4) = 0$$

$$x+7=0$$

$$\boxed{x = -7}$$

$$x-4=0$$

$$\boxed{x = 4}$$

Q.35

$$\frac{2}{x+1} + \frac{3}{2(x-2)} = \frac{23}{5x}$$

$$\frac{2}{x+1} + \frac{3}{2x-4} = \frac{23}{5x}$$

$$4x-8+3x+3 = \frac{23}{5x}$$

$$(x+1)(2x-4) = \frac{23}{5x}$$

$$\frac{7x-5}{2x^2-4x+2x-4} = \frac{23}{5x}$$

$$\frac{7x-5}{2x^2-2x-4} = \frac{23}{5x}$$

$$\frac{7x-5}{2x^2-2x-4} = \frac{23}{5x}$$

$$\frac{7x-5}{2x^2-2x-4} = \frac{23}{5x}$$

$$(5x)(7x-5) = (23)(2x^2-2x-4)$$

$$35x^2 - 25x = 46x^2 - 46x - 92$$

$$46x^2 - 35x^2 - 46x + 25x - 92 = 0$$

$$11x^2 - 21x - 92 = 0$$

$$11x^2 - 44x + 23x - 92 = 0$$

$$11x(x-4) + 23(x-4) = 0$$

$$(x-4)(11x+23) = 0$$

$$x-4=0$$

$$\boxed{x=4}$$

$$11x+23=0$$

$$\boxed{x = -\frac{23}{11}}$$

~~$$Q.37 \quad 3\sqrt{5}x^2 + 25x - 10\sqrt{5} = 0$$~~

~~$$3\sqrt{5}x^2 + 15x + 10x - 10\sqrt{5} = 0$$~~

~~$$3\sqrt{5}(x+\sqrt{5}) + 10(x+\sqrt{5}) = 0$$~~

$$Q.37 \quad 3\sqrt{5}x^2 + 25x - 10\sqrt{5} = 0$$

$$3\sqrt{5}x^2 + 30x - 5x - 10\sqrt{5} = 0$$

$$3\sqrt{5}x(x+2\sqrt{5}) - 5(x+2\sqrt{5}) = 0$$

$$(x+2\sqrt{5})(3\sqrt{5}x-5) = 0$$

$$x+2\sqrt{5} = 0$$

$$\boxed{x = -2\sqrt{5}}$$

$$3\sqrt{5}x-5=0$$

$$x = \frac{5}{3\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$$

$$x = \frac{5}{3 \times \sqrt{5}}$$

$$x = \frac{\sqrt{5}}{3}$$

$$\boxed{x = \frac{\sqrt{5}}{3}}$$

$$Q.38 \quad \sqrt{3}x^2 - 2\sqrt{2}x - 2\sqrt{3} = 0$$

$$\sqrt{3}x^2 - 3\sqrt{2}x + \sqrt{2}x - 2\sqrt{3} = 0$$

$$\sqrt{3}x(x - \sqrt{6}) + \sqrt{2}(x - \sqrt{6}) = 0$$

$$(x - \sqrt{6})(\sqrt{3}x + \sqrt{2}) = 0$$

$$x - \sqrt{6} = 0$$

$$\boxed{x = \sqrt{6}}$$

$$\sqrt{3}x + \sqrt{2} = 0$$

$$x = \frac{-\sqrt{2}}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$$\boxed{x = \frac{-\sqrt{6}}{3}}$$

$$Q.39 \quad 4\sqrt{3}x^2 + 5x - 2\sqrt{3} = 0$$

$$4\sqrt{3}x^2 + 8x - 3x - 2\sqrt{3} = 0$$

$$4x(\sqrt{3}x + 2) - \sqrt{3}(\sqrt{3}x + 2) = 0$$

$$(\sqrt{3}x + 2)(4x - \sqrt{3}) = 0$$

$$\sqrt{3}x + 2 = 0$$

$$x = \frac{-2}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$$\boxed{x = \frac{-2\sqrt{3}}{3}}$$

$$4x - \sqrt{3} = 0$$

$$\boxed{x = \frac{\sqrt{3}}{4}}$$

$$Q.43 \quad \sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$$

$$\sqrt{2}x^2 + 5x + 2x + 5\sqrt{2} = 0$$

$$x(\sqrt{2}x + 5) + \sqrt{2}(\sqrt{2}x + 5) = 0$$

$$(\sqrt{2}x + 5)(x + \sqrt{2}) = 0$$

$$\sqrt{2}x + 5 = 0$$

$$x = \frac{-5}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$$

$$\boxed{x = \frac{-5\sqrt{2}}{2}}$$

$$x + \sqrt{2} = 0$$

$$\boxed{x = -\sqrt{2}}$$

$$Q.44 \quad \frac{m}{n} x^2 + \frac{n}{m} = 1 - 2x$$

$$\frac{m}{n} x^2 + 2x + \frac{n}{m} = 1$$

$$\left(\frac{\sqrt{m}}{\sqrt{n}} x \right)^2 + \left(\frac{\sqrt{n}}{\sqrt{m}} \right)^2 + \left(2x \frac{\sqrt{m}}{\sqrt{n}} x \times \frac{\sqrt{n}}{\sqrt{m}} \right) = 1$$

$$\left(\sqrt{\frac{m}{n}} x + \sqrt{\frac{n}{m}} \right)^2 - (1)^2 = 0$$

$$\left(\sqrt{\frac{m}{n}} x + \sqrt{\frac{n}{m}} + 1 \right) \left(\sqrt{\frac{m}{n}} x + \sqrt{\frac{n}{m}} - 1 \right) = 0$$

$$\frac{\sqrt{m} x}{\sqrt{n}} + \frac{\sqrt{n}}{\sqrt{m}} + 1 = 0$$

$$x = -1 - \frac{\sqrt{n}}{\sqrt{m}}$$

$$x = \frac{-\sqrt{m} - \sqrt{n}}{\sqrt{m}} \times \frac{\sqrt{n}}{\sqrt{m}}$$

$$x = \frac{-\sqrt{mn} - \sqrt{mn}}{m}$$

$$\frac{\sqrt{m} x}{\sqrt{n}} + \frac{\sqrt{n}}{\sqrt{m}} - 1 = 0$$

$$x = 1 - \frac{\sqrt{n}}{\sqrt{m}}$$

$$x = \frac{\sqrt{m} - \sqrt{n}}{\sqrt{m}} \times \frac{\sqrt{n}}{\sqrt{m}}$$

$$x = \frac{\sqrt{mn} - n}{m}$$

$$\frac{x-a}{x-b} + \frac{x-b}{x-a} = \frac{a+b}{b+a}$$

$$\frac{(x-a)^2 + (x-b)^2}{(x-b)(x-a)} = \frac{a^2 + b^2}{ab}$$

$$\frac{x^2 + a^2 - 2ax + x^2 + b^2 - 2bx}{x^2 - ax - bx + ab} = \frac{a^2 + b^2}{ab}$$

$$\frac{2x^2 + a^2 + b^2 - 2ax - 2bx}{x^2 - ax - bx + ab} = \frac{a^2 + b^2}{ab}$$

$$(2x^2 + a^2 + b^2 - 2ax - 2bx)ab = (a^2 + b^2)(x^2 - ax - bx + ab)$$

$$2x^2ab + a^3b + ab^3 - 2a^2bx - 2ab^2x = x^2a^2 - a^3x - a^2bx + a^3b + b^2x^2 - ab^2x - b^3x + ab^3$$

$$2x^2ab - 2a^2bx + a^2bx - 2ab^2x + ab^2x - x^2a^2 + a^3x - b^2x^2 + b^3x = 0$$

$$2x^2ab - a^2bx - ab^2x - x^2a^2 + a^3x - b^2x^2 + b^3x = 0$$

$$2x^2ab - xab(a+b) - x^2(a^2+b^2) + x(a^3+b^3) = 0$$

$$x^2(a^2+b^2-2ab) - x(a^2b+ab^2) + x(a^3+b^3) = 0$$

$$x^2(a-b)^2 + x(-a^3-b^3+a^2b+ab^2) = 0$$

$$x[x(a-b)^2 + (-a^3-b^3+a^2b+ab^2)] = 0$$

$$x = 0$$

$$x(a-b)^2 + (-a^3-b^3+a^2b+ab^2) = 0$$

$$x = \frac{a^3+b^3+a^2b+ab^2}{(a-b)^2}$$

$$x = \frac{a^3+b^3+a^2b+ab^2}{(a-b)^2}$$

$$x = \frac{a^2(a+b) + b^2(a+b)}{(a-b)(a-b)}$$

$$x = \frac{(a+b)(a+b)}{(a-b)(a-b)}$$

$$x = a+b$$

Q. 487

$$\frac{a}{x-b} + \frac{b}{x-a} = 2$$

$$\frac{a(x-a) + b(x-b)}{(x-b)(x-a)} = 2$$

$$\frac{ax - a^2 + bx - b^2}{x^2 - ax - bx + ab} = 2$$

$$ax - a^2 + bx - b^2 = 2(x^2 - ax - bx + ab)$$

$$ax - a^2 + bx - b^2 = 2x^2 - 2ax - 2bx + 2ab$$

$$2x^2 - 2ax - ax - 2bx - bx + a^2 + b^2 + 2ab = 0$$

$$2x^2 - 3ax - 3bx + (a^2 + b^2 + 2ab) = 0$$

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

$$2x^2 - 3(a+b)x + (a+b)^2 = 0$$

$$2x^2 - 2(a+b)x - (a+b)x + (a+b)^2 = 0$$

$$2x[x - (a+b)] - (a+b)[x - (a+b)] = 0$$

$$[x - (a+b)][2x - (a+b)] = 0$$

$$x - (a+b) = 0$$

$$x - a - b = 0$$

$$\boxed{x = a+b}$$

$$2x - (a+b) = 0$$

$$2x - a - b = 0$$

$$\boxed{x = \frac{a+b}{2}}$$

Q. 48

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

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

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

$$\frac{2x^2 + 4}{x^2 + x - 2} = \frac{4x - 2x - 11}{x-2}$$

$$\frac{2x^2 + 4}{x^2 + x - 2} = \frac{2x - 11}{x-2}$$

$$(2x^2 + 4)(x-2) = (2x - 11)(x^2 + x - 2)$$

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

$$- 11x^2 - 11x + 22$$

$$2x^3 - 4x^2 + 4x - 8 = 4x^3 - 2x^3 + 4x^2 - 2x^2 - 11x^2 - 8x$$

$$+ 4x - 11x + 22$$

$$2x^3 - 4x^2 + 4x - 8 = 2x^3 - 9x^2 - 15x + 22$$

$$-4x^2 + 9x^2 + 4x + 15x - 8 - 22 = 0$$

$$5x^2 + 19x - 30 = 0$$

$$5x^2 + 25x - 6x - 30 = 0$$

$$5x(x+5) - 6(x+5) = 0$$

$$(x+5)(5x-6) = 0$$

$$x+5 = 0$$

$$x = -5$$

$$5x - 6 = 0$$

$$x = \frac{6}{5}$$

Quadratic EquationsExercise 4.3

Q.49

$$\frac{a}{x-a} + \frac{b}{x-b} = \frac{2c}{x-c}$$

$$\frac{a(x-b) + b(x-a)}{(x-a)(x-b)} = \frac{2c}{x-c}$$

$$\frac{ax - ab + bx - ab}{x^2 - bx - ax + ab} = \frac{2c}{x-c}$$

$$\frac{ax + bx - 2ab}{x^2 - bx - ax + ab} = \frac{2c}{x-c}$$

$$(x-c)(ax + bx - 2ab) = (2c)(x^2 - bx - ax + ab)$$

$$ax^2 - axc + bx^2 - bxc - 2abx + 2abc = 2x^2c - 2bcx - 2acx + 2abc$$

$$ax^2 - axc + 2acx + bx^2 - bxc + 2bcx - 2abx - 2x^2c = 0$$

$$ax^2 + axc + bx^2 + bxc - 2abx - 2x^2c = 0$$

$$ax^2 + bx^2 - 2abx + axc + bxc - 2x^2c = 0$$

$$x^2 [a+b-2c] - x [ac-bc+2ab] = 0$$

$$x [x(a+b-2c) - (ac-bc+2ab)] = 0$$

$$x = 0 \quad \left| \quad x(a+b-2c) - (2ab-ac-bc) = 0 \right.$$

$$\boxed{x = \frac{2ab-ac-bc}{a+b-2c}}$$

$$Q.51 \quad (a+b)^2 x^2 - 4abx - (a-b)^2 = 0$$

$$(a^2 + b^2 + 2ab)x^2 - 4abx - (a^2 + b^2 - 2ab) = 0$$

$$a^2 x^2 + b^2 x^2 + 2abx^2 - 4abx - a^2 - b^2 + 2ab = 0$$

$$-(a+b)^2 x + (a-b)^2 x = 4abx$$

#

$$(a^2+b)^2 x^2 - (a+b)^2 x + (a-b)^2 x - (a-b)^2 = 0$$

$$(a+b)^2 x [x-1] + (a-b)^2 [x-1] = 0$$

$$(x-1) [(a+b)^2 x + (a-b)^2] = 0$$

$$x-1 = 0$$

$$\boxed{x=1}$$

$$(a+b)^2 x + (a-b)^2 = 0$$

$$x = -\frac{(a-b)^2}{(a+b)^2}$$

$$(a+b)^2$$

$$\boxed{x = -\left(\frac{a-b}{a+b}\right)^2}$$

Q.53 $x^2 - x - a(a+1) = 0$

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

$$(x^2 - a^2) - (x+a) = 0$$

$$(x+a)(x-a) - (x+a) = 0$$

$$(x+a) [(x-a) - 1] = 0$$

$$x+a = 0$$

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

$$x-a-1 = 0$$

$$\boxed{x = (a+1)}$$

Q.55 $abx^2 + (b^2 - ac)x - bc = 0$

$$abx^2 + b^2 x - acx - bc = 0$$

$$bx(ax+b) - c(ax+b) = 0$$

$$(ax+b)(bx-c) = 0$$

$$ax+b = 0$$

$$\boxed{x = -\frac{b}{a}}$$

$$bx-c = 0$$

$$\boxed{x = \frac{c}{b}}$$

$$56 \quad a^2 b^2 x^2 + b^2 x - a^2 x - 1 = 0$$

$$b^2 x(a^2 x + 1) - 1(a^2 x + 1) = 0$$

$$(a^2 x + 1)(b^2 x - 1) = 0$$

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

$$\boxed{x = \frac{-1}{a^2}}$$

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

$$\boxed{x = \frac{1}{b^2}}$$

$$57 \quad \frac{x-1}{x-2} + \frac{x-3}{x-4} = 3 \frac{1}{3}$$

$$\frac{(x-1)(x-4) + (x-3)(x-2)}{(x-2)(x-4)} = \frac{10}{3}$$

$$\frac{x^2 - 4x - x + 4 + x^2 - 2x - 3x + 6}{x^2 - 4x - 2x + 8} = \frac{10}{3}$$

$$\frac{x^2 - 5x + 4 + x^2 - 5x + 6}{x^2 - 6x + 8} = \frac{10}{3}$$

$$(2x^2 - 10x + 10)(3) = (10)(x^2 - 6x + 8)$$

$$6x^2 - 30x + 30 = 10x^2 - 60x + 80$$

$$6x^2 - 10x^2 - 30x + 60x + 30 - 80 = 0$$

$$-4x^2 + 30x - 50 = 0$$

$$2x^2 - 15x + 25 = 0$$

$$2x^2 - 5x - 10x + 25 = 0$$

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

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

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

$$\boxed{x = \frac{5}{2}}$$

$$x-5 = 0$$

$$\boxed{x = 5}$$

Q. 46

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

$$\Rightarrow \frac{(x-3)(x-4) + (x-1)(x-4) + (x-1)(x-2)}{(x-1)(x-2)(x-3)(x-4)} = \frac{1}{6}$$

$$\Rightarrow \frac{x^2 - 4x - 3x + 12 + x^2 - 4x - x + 4 + x^2 - 2x - x + 2}{(x^2 - 2x - x + 2)(x^2 - 4x - 3x + 12)} = \frac{1}{6}$$

$$\Rightarrow \frac{x^2 - 7x + 12 + x^2 - 5x + 4 + x^2 - 3x + 2}{x^4 - 7x^3 + 12x^2 - 3x^3 + 21x^2 - 36x + 2x^2 - 14x + 24} = \frac{1}{6}$$

$$\Rightarrow \frac{3x^2 - 15x + 18}{x^4 - 10x^3 + 35x^2 - 50x + 24} = \frac{1}{6}$$

$$\Rightarrow 18x^2 - 90x + 108 = x^4 - 10x^3 + 35x^2 - 50x + 24$$

$$\Rightarrow x^4 - 10x^3 + 35x^2 - 18x^2 - 50x + 90x + 24 - 108 = 0$$

$$\Rightarrow x^4 - 10x^3 + 17x^2 + 40x - 84 = 0$$

$$\text{If } x = 2,$$

$$\begin{aligned} p(x) &= (2)^4 - 10(2)^3 + 17(2)^2 + 40(2) - 84 \\ &= 16 - 80 + 68 + 80 - 84 \\ &= 164 - 164 \\ &= 0 \end{aligned}$$

$\therefore (x-2)$ is a factor.

As $(x-2)$ is a factor, $\therefore (x^2-4)$ is a factor.

$$\begin{array}{r} x^2 - 10x + 21 \\ x^2 - 4 \overline{) x^4 - 10x^3 + 17x^2 + 40x - 84} \\ \underline{-(x^4 + 0x^3 - 4x^2)} \\ -10x^3 + 21x^2 + 40x - 84 \\ \underline{-(+10x^3 + 0x^2 + 40x)} \\ 21x^2 - 84 \\ \underline{-(+21x^2 + 84)} \\ 0 \end{array}$$

$$x^4 - 10x^3 + 17x^2 + 40x - 84 = 0$$

$$\Rightarrow (x^2 - 4)(x^2 - 10x + 21) = 0$$

$$\Rightarrow (x-2)(x+2)(x^2 - 7x - 3x + 21) = 0$$

$$\Rightarrow (x-2)(x+2)[x(x-7) - 3(x-7)] = 0$$

$$\Rightarrow (x-2)(x+2)(x-7)(x-3) = 0$$

$$x-2=0$$

$$\boxed{x=2}$$

$$x-7=0$$

$$\boxed{x=7}$$

$$x+2=0$$

$$\boxed{x=-2}$$

$$x-3=0$$

$$\boxed{x=3}$$

6/08/2020

classmate

Date _____
Page _____

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

Quadratic Equations

Exercise 4.3

Q.58

$$\frac{1}{2a+b+2x} = \frac{1}{2a} + \frac{1}{b} + \frac{1}{2x}$$

$$\frac{1}{2a+b+2x} - \frac{1}{2x} = \frac{1}{2a} + \frac{1}{b}$$

$$\frac{2x - 2a - b - 2x}{4ax + 2xb + 4x^2} = \frac{2a+b}{2ab}$$

$$\frac{-(2a+b)}{4x^2 + 4ax + 2xb} = \frac{2a+b}{2ab}$$

$$\frac{-1}{4x^2 + 4ax + 2xb} = \frac{1}{2ab}$$

$$4x^2 + 4ax + 2xb = -2ab$$

$$4x^2 + 4ax + 2xb + 2ab = 0$$

$$4x(x+a) + 2b(x+a) = 0$$

$$(x+a)(4x+2b) = 0$$

$$x+a=0$$

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

$$4x+2b=0$$

$$\boxed{x = \frac{-2b}{4}}$$

Q.59

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

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

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

$$\frac{3(9x^2+1-6x) - 2(4x^2+9+12x)}{6x^2-2x+9x-3} = 5$$

$$27x^2 + 3 - 18x - 8x^2 - 18 - 24x = 5(6x^2 + 7x - 3)$$

$$19x^2 - 42x - 15 = 30x^2 + 35x - 15$$

$$30x^2 - 19x^2 + 35x + 42x - 15 + 15 = 0$$

$$11x^2 + 77x = 0$$

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

$$x(x+7) = 0$$

$$x = 0$$

$$x + 7 = 0$$

$$x = -7$$

$$-60 \quad 3\left(\frac{7x+1}{5x-3}\right) - 4\left(\frac{5x-3}{7x+1}\right) = 11$$

$$\frac{3(7x+1)}{(5x-3)} - \frac{4(5x-3)}{(7x+1)} = 11$$

$$\frac{3(7x+1)^2 - 4(5x-3)^2}{(5x-3)(7x+1)} = 11$$

$$\frac{3(49x^2 + 1 + 14x) - 4(25x^2 + 9 - 30x)}{35x^2 + 5x - 21x - 3} = 11$$

$$\frac{147x^2 + 3 + 42x - 100x^2 - 36 + 120x}{35x^2 - 16x - 3} = 11$$

$$47x^2 + 162x - 33 = 11(35x^2 - 16x - 3)$$

$$47x^2 + 162x - 33 = 385x^2 - 176x - 33$$

$$385x^2 - 47x^2 - 176x - 162x - 33 + 33 = 0$$

$$338x^2 - 338x = 0$$

$$338x(x-1) = 0$$

$$338x = 0$$

$$x = 0$$

$$338$$

$$x = 0$$

$$x - 1 = 0$$

$$x = 1$$