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BASIC SKILLS

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OPERATIONS WITH FRACTIONS

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Question 1

Evaluate the following giving the final answer in its simplest form without using mixed numbers.

a) $\frac{2}{5} + \frac{3}{10} =$

$\frac{2}{3} - \frac{4}{9} =$

$\frac{4}{3} \times \frac{3}{8} =$

$\frac{4}{5} \div \frac{3}{7} =$

b) $\frac{1}{2} + \frac{7}{10} =$

$\frac{2}{3} - \frac{1}{12} =$

$\frac{3}{4} \times \frac{8}{9} =$

$\frac{3}{2} \div \frac{5}{12} =$

c) $\frac{2}{3} + \frac{3}{5} =$

$\frac{5}{6} - \frac{3}{8} =$

$\frac{5}{4} \times \frac{1}{8} =$

$\frac{2}{3} \div \frac{5}{6} =$

d) $\frac{3}{4} + \frac{2}{3} =$

$\frac{7}{3} - \frac{9}{4} =$

$\frac{3}{8} \times \frac{16}{3} =$

$\frac{3}{20} \div \frac{1}{40} =$

e) $\frac{5}{3} + \frac{3}{4} =$

$\frac{5}{8} - \frac{5}{12} =$

$\frac{15}{4} \times \frac{8}{5} =$

$\frac{3}{10} \div \frac{6}{5} =$

f) $\frac{1}{2} + \frac{3}{16} =$

$\frac{9}{4} - \frac{3}{7} =$

$\frac{5}{3} \times \frac{7}{15} =$

$\frac{2}{7} \div \frac{11}{14} =$

g) $\frac{5}{3} + \frac{3}{8}$

$\frac{2}{9} - \frac{1}{10}$

$\frac{18}{5} \times \frac{7}{12}$

$\frac{12}{5} \div \frac{12}{7}$

h) $3 \times \frac{3}{4}$

$\frac{5}{4} \times 6$

$\frac{7}{6} \div 2$

$6 \div \frac{12}{5}$

Question 2

Evaluate the following giving the final answer in its simplest form using mixed numbers where appropriate.

a) $1\frac{2}{3} + \frac{7}{4}$

$1\frac{1}{4} + 3\frac{5}{6}$

$1\frac{1}{3} + 2\frac{5}{6}$

$1\frac{1}{2} + 1\frac{3}{4}$

b) $3\frac{1}{2} - 1\frac{3}{4}$

$2\frac{1}{4} - 1\frac{3}{8}$

$1\frac{3}{5} - 1\frac{1}{10}$

$2\frac{1}{3} - 1\frac{3}{4}$

c) $1\frac{5}{8} \times \frac{3}{4}$

$\frac{1}{4} \times 2\frac{1}{3}$

$2\frac{5}{8} \times \frac{3}{16}$

$3 \times 2\frac{5}{7}$

d) $1\frac{5}{6} \times 3$

$2\frac{5}{9} \div \frac{23}{3}$

$1\frac{5}{6} \times 3\frac{1}{2}$

$1\frac{2}{3} \div 3$

e) $1\frac{3}{13} \div \frac{15}{26}$

$2\frac{3}{7} \div 3\frac{1}{2}$

$\frac{4}{9} \times 2\frac{1}{3}$

$2\frac{2}{5} \div 4$

Question 3

Evaluate the following giving the final answer in its simplest form.

- a) $\frac{3}{\frac{3}{4}}$ $\frac{\frac{3}{4}}{4} =$ $\frac{\frac{2}{3}}{\frac{1}{6}}$ $\frac{3}{\frac{1}{2}} + \frac{1}{\frac{2}{3}}$
- b) $\frac{2}{\frac{1}{3}} \times \frac{1}{\frac{2}{4}}$ $\frac{\frac{1}{2}}{\frac{1}{4}} - \frac{1}{\frac{4}{2}}$ $\frac{\frac{3}{5}}{\frac{7}{10}} \div \frac{7}{\frac{2}{3}}$ $\frac{3}{\frac{2}{9}} \times \frac{1}{\frac{6}{5}} \times \frac{10}{\frac{3}{5}}$
- c) $\frac{2 + \frac{3}{4}}{2 - \frac{3}{4}}$ $\frac{\frac{1}{2} + \frac{3}{4}}{5 - \frac{1}{4}}$ $\frac{\frac{1}{2} + \frac{1}{3}}{\frac{1}{4} + \frac{1}{6}}$ $\frac{\frac{1}{2} + \frac{3}{4}}{\frac{1}{2} - \frac{2}{5}}$
- d) $\frac{\frac{1}{2} + \frac{2}{3}}{\frac{3}{4} + \frac{4}{5}}$ $\frac{\frac{3}{4} + \frac{1}{2}}{1 - \frac{3}{4} \times \frac{1}{2}}$ $\frac{1 + \frac{1}{2} \times \frac{3}{5}}{\frac{3}{4} + \frac{2}{5} + \frac{3}{20}}$ $\frac{\frac{1}{2} + \frac{1}{2} \times \frac{3}{5}}{\frac{3}{4} \times \frac{2}{5} - \frac{1}{6}}$
- e) $1\frac{3}{13} \div \frac{15}{26}$ $2\frac{3}{7} \div 3\frac{1}{2}$ $\frac{4}{9} \times 2\frac{1}{3}$ $2\frac{2}{5} \div 4$

SIMPLIFYING EXPRESSIONS

Question 4

Simplify fully each of the following expressions.

a) $4(2x-1)-3(2x-7)=$

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

c) $2x-4(2x-1)-(4-5x)=$

d) $6-3(2x+3)-(7-2x)=$

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

Question 5

Simplify fully each of the following expressions.

a) $4(2x-3)-2(3x-8)=$

b) $5(3x-3)-3(5x-7)=$

c) $9x-2(3x-4)-(7-x)=$

d) $8-2(7x+1)-(3-5x)=$

e) $7(2x-5)-5(5-2x)=$

Question 6

Simplify fully each of the following expressions.

a) $4x(x-2) - 2(x^2 + 3x - 1) =$

b) $4x(3-x) - 2x(x-2) =$

c) $2x(3x-7) - 4x - x(2-5x) =$

d) $4x(3x-2) - (10 - 4x - 5x^2) =$

e) $4(2x^2 - 3) - x(3-x) =$

Question 7

Simplify fully each of the following expressions.

a) $3x(x-3) - 2(x^2 - 3x + 1) =$

b) $7x(3-x) - 2(4 - 2x^2) =$

c) $6x(2x-5) + 9x - 7x(2+x) =$

d) $2x(2-5x) - (1 - 4x - 11x^2) =$

e) $(2x+3)(3x-2) - 2x(3+4x) - (1-2x-2x^2) =$

Question 8

Simplify fully each of the following expressions.

a) $4(x^2 - 3x) - (x+1)(x+4) =$

b) $2(3x^2 - 5) - (x+2)(x-3) =$

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

d) $2x(4 - 3x) - (2x-1)(1-3x) =$

e) $6x - x(2 - x) - 2(x-1)(x+2) =$

Question 9

Expand the brackets and simplify fully each of the following expressions.

a) $(x+3)(x+1)(x+1)$

b) $(x-2)(x-5)(x+1)$

c) $(x-2)(x-3)(x+4)$

d) $(x-3)(x+2)(x+4)$

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

Question 10

Expand the brackets and simplify fully each of the following expressions.

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

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

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

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

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

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QUADRATIC FACTORIZATION

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Question 11

Factorize each of the following quadratic expressions.

a) $x^2 - 8x - 9$

b) $x^2 + 7x + 10$

c) $x^2 - 7x + 12$

d) $x^2 + 4x - 12$

e) $x^2 + 8x - 20$

f) $x^2 - 6x - 16$

g) $x^2 - 11x + 24$

h) $x^2 + 10x + 24$

Question 12

Factorize each of the following quadratic expressions.

a) $x^2 + 5x - 6$

b) $x^2 + 7x + 12$

c) $x^2 + 7x - 18$

d) $x^2 - 8x + 15$

e) $x^2 - x - 20$

f) $x^2 - 11x + 18$

g) $x^2 + x - 30$

h) $x^2 - 12x + 20$

Question 13

Factorize each of the following quadratic expressions.

a) $x^2 - 12x + 36$

b) $x^2 + 4x - 12$

c) $x^2 + 9x + 18$

d) $x^2 + 2x - 15$

e) $x^2 + 8x + 15$

f) $x^2 - 7x + 12$

g) $x^2 + x - 12$

h) $x^2 - 8x + 16$

Question 14

Factorize each of the following quadratic expressions.

a) $x^2 + 3x - 28$

b) $x^2 - 2x - 24$

c) $x^2 - 10x + 21$

d) $x^2 + 14x + 24$

e) $x^2 - 12x + 32$

f) $x^2 + 13x - 30$

g) $x^2 - 11x + 28$

h) $x^2 + 12x + 32$

Question 15

Factorize each of the following quadratic expressions.

a) $x^2 - 3x - 40$

b) $x^2 - 14x + 24$

c) $x^2 + 13x + 36$

d) $x^2 - 17x + 42$

e) $x^2 + 18x + 45$

f) $x^2 + 14x + 40$

g) $x^2 - 19x + 48$

h) $x^2 - 8x - 48$

Question 16

Factorize each of the following quadratic expressions.

a) $x^2 - 14x + 45$

b) $x^2 - 15x + 50$

c) $x^2 + 6x - 40$

d) $x^2 - 30x + 56$

e) $x^2 - 9x - 52$

f) $x^2 + 4x - 45$

g) $x^2 + 15x + 56$

h) $x^2 + 37x - 360$

Question 17

Factorize each of the following quadratic expressions.

a) $2x^2 - 5x + 3$

b) $2x^2 - 11x + 15$

c) $3x^2 - 10x + 8$

d) $2x^2 - x - 10$

e) $3x^2 + 11x + 6$

f) $3x^2 - 8x + 4$

g) $5x^2 + 6x - 8$

h) $2x^2 - 9x - 18$

Question 18

Factorize each of the following quadratic expressions.

a) $3x^2 - 5x - 12$

b) $5x^2 + 19x - 4$

c) $3x^2 - 16x + 5$

d) $3x^2 - 11x + 6$

e) $3x^2 + x - 4$

f) $3x^2 + x - 2$

g) $2x^2 + 7x + 5$

h) $3x^2 + 11x - 4$

Question 19

Factorize each of the following quadratic expressions.

a) $2x^2 + 7x + 6$

b) $5x^2 - 12x - 9$

c) $2x^2 - 13x - 24$

d) $3x^2 + 2x - 8$

e) $2x^2 + 13x + 15$

f) $2x^2 + 3x - 20$

g) $2x^2 - 5x - 18$

h) $3x^2 + 22x - 16$

Question 20

Factorize each of the following quadratic expressions.

a) $3x^2 - 17x + 20$

b) $2x^2 - 3x - 5$

c) $5x^2 - 7x + 2$

d) $3x^2 + 13x + 12$

e) $2x^2 - 15x + 27$

f) $7x^2 - 9x - 10$

g) $3x^2 - 13x + 14$

h) $2x^2 + 9x - 18$

Question 21

Factorize each of the following quadratic expressions.

a) $2x^2 + 7x - 30$

b) $2x^2 + 11x - 30$

c) $4x^2 + 8x + 3$

d) $4x^2 - 11x - 3$

e) $4x^2 + 4x - 15$

f) $4x^2 - 7x - 2$

g) $4x^2 + 5x - 6$

h) $4x^2 - 8x - 5$

Question 22

Factorize each of the following quadratic expressions.

a) $4x^2 - 5x - 9$

b) $4x^2 + 16x + 15$

c) $4x^2 - 19x - 5$

d) $4x^2 - 33x + 8$

e) $4x^2 + 5x - 9$

f) $4x^2 - 20x + 9$

g) $4x^2 - 11x - 20$

h) $4x^2 + 5x - 21$

Question 23

Factorize each of the following quadratic expressions.

a) $4x^2 - 27x + 18$

b) $6x^2 + 7x - 3$

c) $6x^2 - 5x - 4$

d) $6x^2 + 19x + 10$

e) $6x^2 + 7x - 10$

f) $6x^2 - 13x - 15$

g) $6x^2 - 17x + 10$

h) $6x^2 - 13x + 6$

Question 24

Factorize each of the following quadratic expressions.

a) $6x^2 + x - 12$

b) $6x^2 + 11x - 10$

c) $8x^2 - 10x - 3$

d) $8x^2 + 14x + 3$

e) $8x^2 - 5x - 3$

f) $8x^2 - 22x + 5$

g) $8x^2 - 6x - 5$

h) $8x^2 + 3x - 5$

Question 25

Factorize each of the following quadratic expressions.

a) $12x^2 + 7x + 1$

b) $12x^2 + 4x - 1$

c) $12x^2 + 5x - 3$

d) $12x^2 - 17x + 5$

e) $12x^2 - 7x - 5$

f) $12x^2 + 5x - 7$

g) $12x^2 - 16x + 5$

h) $12x^2 - 13x - 4$

Question 26

Factorize each of the following quadratic expressions.

a) $12x^2 - 29x - 60$

b) $21x^2 - 17x + 2$

SQUARING BRACKETS

Question 27

Square the following brackets.

a) $(x+3)^2$

b) $(y-9)^2$

c) $(a+1)^2$

d) $(k-6)^2$

e) $(1+w)^2$

f) $(2-v)^2$

Question 28

Square the following brackets.

a) $(5+x)^2$

b) $(4-b)^2$

c) $(t+2)^2$

d) $(y-5)^2$

e) $(b+7)^2$

f) $(c-8)^2$

Question 29

Square the following brackets.

a) $(6+k)^2$

b) $(3-p)^2$

c) $(8+d)^2$

d) $(7-m)^2$

e) $(q+10)^2$

f) $(2n-1)^2$

Question 30

Square the following brackets.

a) $(3x+2)^2$

b) $(2z-3)^2$

c) $(4n+1)^2$

d) $(3p+4)^2$

e) $(2k-2)^2$

f) $(4-2n)^2$

Question 31

Square the following brackets.

a) $(3+4p)^2$

b) $(2y-9)^2$

c) $(5a+1)^2$

d) $(6b+2)^2$

e) $(4h-2)^2$

f) $(6-2y)^2$

Question 32

Square the following brackets.

a) $(1+4q)^2$

b) $(3-5k)^2$

c) $(7d-1)^2$

d) $(6x+4)^2$

e) $(3y-3)^2$

f) $(7-2w)^2$

Question 33

Square the following brackets.

a) $(8+2n)^2$

b) $(1-5c)^2$

c) $(4m-1)^2$

d) $(8p+1)^2$

e) $(6n-1)^2$

f) $(3m+2)^2$

Question 34

Square the following brackets.

a) $(4h-4)^2$

b) $(3-2x)^2$

c) $(1+4c)^2$

d) $(5-2p)^2$

e) $(7t+5)^2$

f) $(5d-2)^2$

Question 35

Square the following brackets.

a) $(3z - 4)^2$

b) $(1 - 7w)^2$

c) $(2 + 4y)^2$

d) $(2 - 6k)^2$

e) $(5b - 1)^2$

f) $(5m - 4)^2$

Question 36

Square the following brackets.

a) $(8v - 1)^2$

b) $(6 - 2t)^2$

c) $(9 + 2c)^2$

d) $(1 - 10n)^2$

e) $(4x - 5)^2$

f) $(12a + 1)^2$

DIFFERENCE OF SQUARES

Question 37

Factorize:

a) $x^2 - 16$

b) $25 - a^2$

c) $y^2 - 1$

d) $81 - b^2$

e) $t^2 - 36$

f) $64 - w^2$

g) $n^2 - 100$

h) $4 - d^2$

i) $p^2 - 9$

j) $49 - c^2$

Question 38

Factorize:

a) $36w^2 - 16$

b) $9x^2 - 25$

c) $4y^2 - 1$

d) $16k^2 - 81$

e) $25v^2 - 36$

f) $9w^2 - 64$

g) $9m^2 - 100$

h) $9z^2 - 4$

i) $16p^2 - 9$

j) $25c^2 - 49$

COMPLETING THE SQUARE

Question 39

Complete the square in the following quadratics and then state the coordinates of their maximum or minimum point.

a) $y = x^2 - 8x - 2$

b) $y = x^2 + 6x + 10$

c) $y = x^2 - 4x + 1$

d) $y = x^2 + 4x + 9$

e) $y = x^2 + 8x + 20$

Question 40

Complete the square in the following quadratics and then state the coordinates of their maximum or minimum point.

a) $y = x^2 - 6x + 10$

b) $y = x^2 - 10x + 24$

c) $y = x^2 + 10x + 30$

d) $y = x^2 - 12x - 4$

e) $y = x^2 + 14x + 29$

Question 41

Complete the square in the following quadratics and then state the coordinates of their maximum or minimum point.

a) $y = x^2 + 2x$

b) $y = x^2 - 8x$

c) $y = x^2 - 2x + 7$

d) $y = x^2 + 6x + 10$

e) $y = x^2 - 12x + 27$

Question 42

Complete the square in the following quadratics and then state the coordinates of their maximum or minimum point.

a) $y = x^2 + 12x + 36$

b) $y = x^2 - 4x + 6$

c) $y = x^2 - 16x + 40$

d) $y = x^2 - 8x + 18$

e) $y = x^2 + 14x + 50$

Question 43

Complete the square in the following quadratics and then state the coordinates of their maximum or minimum point.

a) $y = x^2 - 7x + 10$

b) $y = x^2 + 3x + 10$

c) $y = x^2 + x + 1$

d) $y = 2x^2 - 8x + 10$

e) $y = 3x^2 - 18x + 24$

Question 44

Complete the square in the following quadratics and then state the coordinates of their maximum or minimum point.

a) $y = 4x^2 - 8x + 28$

b) $y = 5x^2 + 20x + 15$

c) $y = 3x^2 + 24x + 45$

d) $y = 4x^2 - 8x + 16$

e) $y = 5x^2 + 10x$

Question 45

Complete the square in the following quadratics and then state the coordinates of their maximum or minimum point.

a) $y = -x^2 + 4x - 3$

b) $y = -x^2 - 12x - 32$

c) $y = -x^2 - 6x - 7$

d) $y = -x^2 + 14x$

e) $y = -x^2 + 2x - 15$

Question 46

Complete the square in the following quadratics and then state the coordinates of their maximum or minimum point.

a) $y = -2x^2 + 12x + 36$

b) $y = -4x^2 + 4x - 3$

c) $y = -x^2 - x - 2$

d) $y = -x^2 - 3x + \frac{1}{4}$

e) $y = -2x^2 + \frac{1}{2}x - \frac{9}{8}$

REARRANGE FORMULAE

Question 47

Rearrange the following formulae for the variable written inside the square bracket.

a) $v = u + at$ $[a]$ (*)

b) $y = 2x + 3$ $[x]$ (*)

c) $y = bt - 3$ $[t]$ (*)

d) $A = \pi r^2$ $[r]$ (*)

e) $v^2 = u^2 + 2as$ $[u]$ (*)

f) $P = T - 7Q$ $[Q]$ (*+)

g) $X = R - QT$ $[Q]$ (*+)

h) $F = Mr^3$ $[M]$ (*+)

i) $V = Bx^3$ $[x]$ (*+)

Question 48

Rearrange the following formulae for the variable written inside the square bracket.

a) $s = \frac{v}{t}$ $[t]$ (*)

b) $h = \frac{V}{mg}$ $[m]$ (*)

c) $A = \frac{xy}{2t}$ $[t]$ (*)

d) $s = \frac{1}{2}at^2$ $[t]$ (*)

e) $E = \frac{1}{2}mv^2$ $[m]$ (*)

f) $V = \frac{4}{3}\pi r^3$ $[r]$ (**)

g) $V = \frac{1}{3}\pi r^2 h$ $[r]$ (**)

h) $E = \frac{3}{4}x^2$ $[x]$ (**)

i) $T = \lambda \frac{x}{a}$ $[x]$ (**+)

Question 49

Rearrange the following formulae for the variable written inside the square bracket.

a) $E = \frac{\lambda}{2a}x^2$ [x] (**+)

b) $F = G\frac{mM}{r^2}$ [m] (**+)

c) $\sqrt{y} = 2x$ [y] (**+)

d) $\sqrt{y-1} = 3x$ [y] (**+)

e) $A = 2\pi r(r+h)$ [h] (**+)

f) $s = \frac{u+v}{2}t$ [u] (**+)

g) $B = Ax^2 - T$ [x] (***)

h) $Y = \frac{1}{2}Bx^2$ [x] (***)

Question 50

Rearrange the following formulae for the variable written inside the square bracket.

a) $v^2 = \omega^2(a^2 - x^2)$ $[x]$ (***)

b) $s = ut + \frac{1}{2}at^2$ $[a]$ (***)

c) $2\pi rh + \pi r^2 = 600$ $[h]$ (***)

d) $\pi rt + \frac{1}{3}\pi kr^2 = A$ $[t]$ (***)

e) $C = \frac{a}{x^2}$ $[x]$ (***)

f) $S = \frac{1}{a^2}$ $[a]$ (***)

g) $\sqrt{y} - 1 = 2x$ $[y]$ (***)

h) $kt - kh = c$ $[k]$ (***)

Question 51

Rearrange the following formulae for the variable written inside the square bracket.

a) $2R + QR = QT$ $[R]$ (***)

b) $2R + QR = QT$ $[Q]$ (***+)

c) $2x - 5y = y - mx$ $[x]$ (***+)

d) $(u - 1)^2 = v$ $[u]$ (***+)

e) $x = \frac{2}{\sqrt{y}}$ $[y]$ (***+)

f) $x = \frac{1}{\sqrt{y+1}}$ $[y]$ (***+)

g) $T = \frac{8}{L^3}$ $[L]$ (***+)

h) $y + 5 = x(y + 2)$ $[y]$ (****)

Question 52

Rearrange the following formulae for the variable written inside the square bracket.

a) $y = \frac{x+a}{x+b}$ [x] (****)

b) $\frac{tk}{h} = k-1$ [k] (****)

c) $T = \frac{Q}{Q+2}$ [Q] (****)

d) $y = \frac{x+k}{2x+k}$ [x] (****)

e) $\frac{x+1}{x} = \frac{y}{y+1}$ [y] (****)

f) $\frac{x+1}{x-1} = \frac{y-2}{y+3}$ [y] (****)

g) $T = \frac{2(1+x)}{a(1-x)}$ [x] (****+)

h) $y = x\sqrt{y^2+1}$ [y] (****+)

Question 53

Rearrange the following formulae for the variable written inside the square bracket.

a) $y = \frac{x^2}{a^2 - x^2}$ [x] (****+)

b) $x = \sqrt{\frac{y}{y+1}}$ [y] (****+)

c) $x = \sqrt{\frac{y-1}{2y}}$ [y] (****+)

d) $x = \sqrt{\frac{4y}{3-y}}$ [y] (****+)

e) $x = \sqrt{\frac{y+1}{y-1}}$ [y] (****+)

f) $x = 2\sqrt{\frac{y}{y-1}}$ [y] (****+)

g) $x = \frac{4}{y}\sqrt{y^2-1}$ [y] (****+)

h) $x = \sqrt{y^2-9}$ [y] (****+)

Question 54

Rearrange the following formulae for the variable written inside the square bracket.

a) $\frac{y^2}{y^2+1} = \frac{x^2-1}{x^2}$ [y] (****+)

b) $T = 2\pi\sqrt{\frac{L}{g}}$ [L] (****+)

c) $V = \frac{1}{3}\pi r^2\sqrt{L^2-r^2}$ [L] (****+)

d) $A = \frac{h}{2}(a+b) + \frac{b}{2}(a+h)$ [a] (****+)

e) $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ [u] (****+)

f) $u^2 = v - 2u$ [u] (*****)

g) $x^2 + y^2 = 2xy + z^2$ [x] (*****)

h) $x + \sqrt{x} = y$ [x] (*****)

