BASIC SKILLS

OPERATIONS WITH FRACTIONS

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) $\dfrac{3}{\frac{3}{4}}$ $\qquad \dfrac{\frac{3}{4}}{4}=$ $\qquad \dfrac{\frac{2}{3}}{\frac{1}{6}}$ $\qquad \dfrac{3}{\frac{1}{2}}+\dfrac{\frac{1}{2}}{3}$

b) $\dfrac{2}{\frac{1}{3}}\times\dfrac{\frac{1}{2}}{4}$ $\qquad \dfrac{\frac{1}{2}}{\frac{1}{4}}-\dfrac{\frac{1}{4}}{\frac{1}{2}}$ $\qquad \dfrac{\frac{3}{5}}{\frac{7}{10}}\div\dfrac{7}{\frac{2}{3}}$ $\qquad \dfrac{3}{\frac{2}{9}}\times\dfrac{\frac{1}{6}}{5}\times\dfrac{10}{\frac{3}{5}}$

c) $\dfrac{2+\frac{3}{4}}{2-\frac{3}{4}}$ $\qquad \dfrac{\frac{1}{2}+\frac{3}{4}}{5-\frac{1}{4}}$ $\qquad \dfrac{\frac{1}{2}+\frac{1}{3}}{\frac{1}{4}+\frac{1}{6}}$ $\qquad \dfrac{\frac{1}{2}+\frac{3}{4}}{\frac{1}{2}-\frac{2}{5}}$

d) $\dfrac{\frac{1}{2}+\frac{2}{3}}{\frac{3}{4}+\frac{4}{5}}$ $\qquad \dfrac{\frac{3}{4}+\frac{1}{2}}{1-\frac{3}{4}\times\frac{1}{2}}$ $\qquad \dfrac{1+\frac{1}{2}\times\frac{3}{5}}{\frac{3}{4}+\frac{2}{5}+\frac{3}{20}}$ $\qquad \dfrac{\frac{1}{2}+\frac{1}{2}\times\frac{3}{5}}{\frac{3}{4}\times\frac{2}{5}-\frac{1}{6}}$

e) $1\frac{3}{13}\div\frac{15}{26}$ $\qquad 2\frac{3}{7}\div3\frac{1}{2}$ $\qquad \frac{4}{9}\times2\frac{1}{3}$ $\qquad 2\frac{2}{5}\div4$

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) $4x(x-2)-2\left(x^2+3x-1\right)=$

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

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

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

e) $4\left(2x^2-3\right)-x(3-x)=$

Question 7

Simplify fully each of the following expressions.

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

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

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

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

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

Question 8

Simplify fully each of the following expressions.

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

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

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

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

QUADRATIC FACTORIZATION

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

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

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

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

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

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

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

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

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

Question 48

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

a) $s=\dfrac{v}{t}\quad [t]$ (*+)

b) $h=\dfrac{V}{mg}\quad [m]$ (*+)

c) $A=\dfrac{xy}{2t}\quad [t]$ (*+)

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

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

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

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

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

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

Question 49

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

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

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

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

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

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

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

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

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

Question 50

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

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

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

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

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

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

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

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

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

Question 51

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

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

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

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

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

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

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

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

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

Question 52

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

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

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

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

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

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

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

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

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

Question 53

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

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

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

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

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

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

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

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

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

Question 54

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

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

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

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

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

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

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

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

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

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