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

# OPERATIONS WITH FRACTIONS

## Question 1

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

| | | | | |
|---|---|---|---|---|
| **1.** | $\frac{2}{5}+\frac{3}{10}=\frac{7}{10}$ | $\frac{2}{3}-\frac{4}{9}=\frac{2}{9}$ | $\frac{4}{3}\times\frac{3}{8}=\frac{1}{2}$ | $\frac{4}{5}\div\frac{3}{7}=\frac{28}{15}$ |
| **2.** | $\frac{1}{2}+\frac{7}{10}=\frac{6}{5}$ | $\frac{2}{3}-\frac{1}{12}=\frac{7}{12}$ | $\frac{3}{4}\times\frac{8}{9}=\frac{2}{3}$ | $\frac{3}{2}\div\frac{5}{12}=\frac{18}{5}$ |
| **3.** | $\frac{2}{3}+\frac{3}{5}=\frac{19}{15}$ | $\frac{5}{6}-\frac{3}{8}=\frac{11}{24}$ | $\frac{5}{4}\times\frac{1}{8}=\frac{5}{32}$ | $\frac{2}{3}\div\frac{5}{6}=\frac{4}{5}$ |
| **4.** | $\frac{3}{4}+\frac{2}{3}=\frac{17}{12}$ | $\frac{7}{3}-\frac{9}{4}=\frac{1}{12}$ | $\frac{3}{8}\times\frac{16}{3}=2$ | $\frac{3}{20}\div\frac{1}{40}=6$ |
| **5.** | $\frac{5}{3}+\frac{3}{4}=\frac{29}{12}$ | $\frac{5}{8}-\frac{5}{12}=\frac{5}{24}$ | $\frac{15}{4}\times\frac{8}{5}=6$ | $\frac{3}{10}\div\frac{6}{5}=\frac{1}{4}$ |
| **6.** | $\frac{1}{2}+\frac{3}{16}=\frac{11}{16}$ | $\frac{9}{4}-\frac{3}{7}=\frac{51}{28}$ | $\frac{5}{3}\times\frac{7}{15}=\frac{7}{9}$ | $\frac{2}{7}\div\frac{11}{14}=\frac{4}{11}$ |
| **7.** | $\frac{5}{3}+\frac{3}{8}=\frac{49}{24}$ | $\frac{2}{9}-\frac{1}{10}=\frac{11}{90}$ | $\frac{18}{5}\times\frac{7}{12}=\frac{21}{10}$ | $\frac{12}{5}\div\frac{12}{7}=\frac{7}{5}$ |
| **8.** | $3\times\frac{3}{4}=\frac{9}{4}$ | $\frac{5}{4}\times6=\frac{15}{2}$ | $\frac{7}{6}\div2=\frac{7}{12}$ | $6\div\frac{12}{5}=\frac{5}{2}$ |

## Question 2

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

| | | | | |
|---|---|---|---|---|
| **1.** | $1\frac{2}{3}+\frac{7}{4}=3\frac{5}{12}$ | $1\frac{1}{4}+3\frac{5}{6}=5\frac{1}{12}$ | $1\frac{1}{3}+2\frac{5}{6}=4\frac{1}{6}$ | $1\frac{1}{2}+1\frac{3}{4}=3\frac{1}{4}$ |
| **2.** | $3\frac{1}{2}-1\frac{3}{4}=1\frac{3}{4}$ | $2\frac{1}{4}-1\frac{3}{8}=\frac{7}{8}$ | $1\frac{3}{5}-1\frac{1}{10}=\frac{1}{2}$ | $2\frac{1}{3}-1\frac{3}{4}=\frac{7}{12}$ |
| **3.** | $1\frac{5}{8}\times\frac{3}{4}=\frac{39}{32}=1\frac{7}{32}$ | $\frac{1}{4}\times2\frac{1}{3}=\frac{7}{12}$ | $2\frac{5}{8}\times\frac{3}{16}=\frac{63}{128}$ | $3\times2\frac{5}{7}=\frac{57}{7}=8\frac{1}{7}$ |
| **4.** | $1\frac{5}{6}\times3=\frac{11}{2}=5\frac{1}{2}$ | $2\frac{5}{9}\div\frac{23}{3}=\frac{1}{3}$ | $1\frac{5}{6}\times3\frac{1}{2}=\frac{77}{12}=6\frac{5}{12}$ | $1\frac{2}{3}\div3=\frac{5}{9}$ |
| **5.** | $1\frac{3}{13}\div\frac{15}{26}=\frac{32}{15}=2\frac{2}{15}$ | $2\frac{3}{7}\div3\frac{1}{2}=\frac{34}{49}$ | $\frac{4}{9}\times2\frac{1}{3}=\frac{4}{21}$ | $2\frac{2}{5}\div4=\frac{3}{5}$ |

## Question 3

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

**1.** $\dfrac{3}{\frac{3}{4}}=4$ $\qquad$ $\dfrac{\frac{3}{4}}{4}=\dfrac{3}{16}$ $\qquad$ $\dfrac{\frac{2}{3}}{\frac{1}{6}}=4$ $\qquad$ $\dfrac{3}{\frac{1}{2}}+\dfrac{\frac{1}{2}}{3}=\dfrac{37}{6}$

**2.** $\dfrac{2}{\frac{1}{3}}\times\dfrac{\frac{1}{2}}{4}=\dfrac{3}{4}$ $\qquad$ $\dfrac{\frac{1}{2}}{\frac{1}{4}}-\dfrac{\frac{1}{4}}{\frac{1}{2}}=\dfrac{3}{2}$ $\qquad$ $\dfrac{\frac{3}{5}}{\frac{7}{10}}\div\dfrac{7}{\frac{2}{3}}=\dfrac{4}{49}$ $\qquad$ $\dfrac{3}{\frac{2}{9}}\times\dfrac{\frac{1}{6}}{5}\times\dfrac{10}{\frac{3}{5}}=\dfrac{15}{2}$

**3.** $\dfrac{2+\frac{3}{4}}{2-\frac{3}{4}}=\dfrac{11}{5}$ $\qquad$ $\dfrac{\frac{1}{2}+\frac{3}{4}}{5-\frac{1}{4}}=\dfrac{5}{19}$ $\qquad$ $\dfrac{\frac{1}{2}+\frac{1}{3}}{\frac{1}{4}+\frac{1}{6}}=2$ $\qquad$ $\dfrac{\frac{1}{2}+\frac{3}{4}}{\frac{1}{2}-\frac{2}{5}}=\dfrac{25}{2}$

**4.** $\dfrac{\frac{1}{2}+\frac{2}{3}}{\frac{3}{4}+\frac{4}{5}}=\dfrac{70}{93}$ $\qquad$ $\dfrac{\frac{3}{4}+\frac{1}{2}}{1-\frac{3}{4}\times\frac{1}{2}}=2$ $\qquad$ $\dfrac{1+\frac{1}{2}\times\frac{3}{5}}{\frac{3}{4}+\frac{2}{5}+\frac{3}{20}}=1$ $\qquad$ $\dfrac{\frac{1}{2}+\frac{1}{2}\times\frac{3}{5}}{\frac{3}{4}\times\frac{2}{5}-\frac{1}{6}}=6$

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

# SIMPLIFYING EXPRESSIONS

## Question 4

Simplify fully the following expressions.

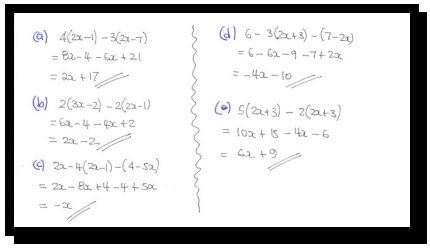
1. $4(2x-1)-3(2x-7)=2x+17$

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

3. $2x-4(2x-1)-(4-5x)=-x$

4. $6-3(2x+3)-(7-2x)=-4x-10$

5. $5(2x+3)-2(2x+3)=6x+9$



## Question 5

Simplify fully the following expressions.

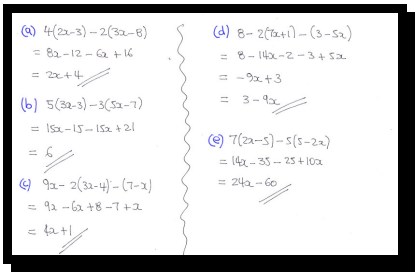
**a)** $4(2x-3)-2(3x-8)=2x+4$

**b)** $5(3x-3)-3(5x-7)=6$

**c)** $9x-2(3x-4)-(7-x)=4x+1$

**d)** $8-2(7x+1)-(3-5x)=3-9x$

**e)** $7(2x-5)-5(5-2x)=24x-60$



## Question 6

Simplify fully the following expressions.

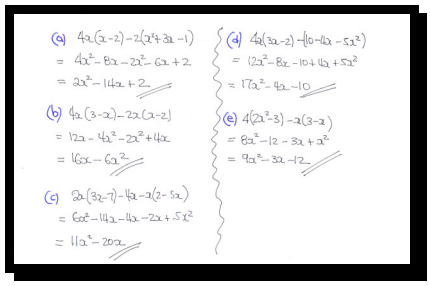
**a)** $4x(x-2)-2\left(x^2+3x-1\right)=2x^2-14x+2$

**b)** $4x(3-x)-2x(x-2)=-6x^2+16x$

**c)** $2x(3x-7)-4x-x(2-5x)=11x^2-20x$

**d)** $4x(3x-2)-\left(10-4x-5x^2\right)=17x^2-4x-10$

**e)** $4\left(2x^2-3\right)-x(3-x)=9x^2-3x-12$



## Question 7

Simplify fully the following expressions.

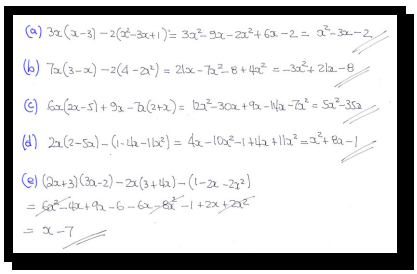
**a)** $3x(x-3)-2(x^2-3x+1)=x^2-3x-2$

**b)** $7x(3-x)-2(4-2x^2)=-3x^2+21x-8$

**c)** $6x(2x-5)+9x-7x(2+x)=5x^2-35x$

**d)** $2x(2-5x)-(1-4x-11x^2)=x^2+8x-1$

**e)** $(2x+3)(3x-2)-2x(3+4x)-(1-2x-2x^2)=x-7$



## Question 8

Simplify fully the following expressions.

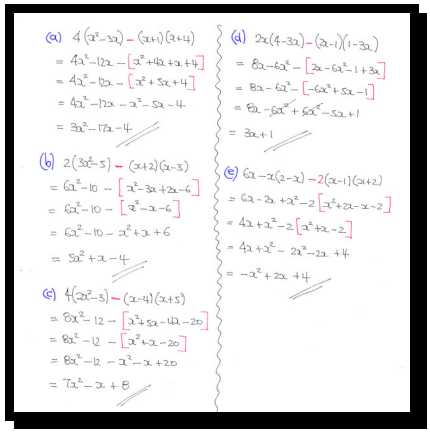
**a)** $4\left(x^2-3x\right)-(x+1)(x+4)=3x^2-17x-4$

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

**c)** $4\left(2x^2-3\right)-(x-4)(x+5)=7x^2-x+8$

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

**e)** $6x-x(2-x)-2(x-1)(x+2)=-x^2+2x+4$


(a) $4(x^2-3x)-(x+1)(x+4)$
$=4x^2-12x-[x^2+4x+x+4]$
$=4x^2-12x-[x^2+5x+4]$
$=4x^2-12x-x^2-5x-4$
$=3x^2-17x-4$

(b) $2(3x^2-5)-(x+2)(x-3)$
$=6x^2-10-[x^2-3x+2x-6]$
$=6x^2-10-[x^2-x-6]$
$=6x^2-10-x^2+x+6$
$=5x^2+x-4$

(c) $4(2x^2-3)-(x-4)(x+5)$
$=8x^2-12-[x^2+5x-4x-20]$
$=8x^2-12-[x^2+x-20]$
$=8x^2-12-x^2-x+20$
$=7x^2-x+8$

(d) $2x(4-3x)-(2x-1)(1-3x)$
$=8x-6x^2-[2x-6x^2-1+3x]$
$=8x-6x^2-[-6x^2+5x-1]$
$=8x-6x^2+6x^2-5x+1$
$=3x+1$

(e) $6x-x(2-x)-2(x-1)(x+2)$
$=6x-2x+x^2-2[x^2+2x-x-2]$
$=4x+x^2-2[x^2+x-2]$
$=4x+x^2-2x^2-2x+4$
$=-x^2+2x+4$

## Question 9

Expand the brackets and simplify fully the following expressions.

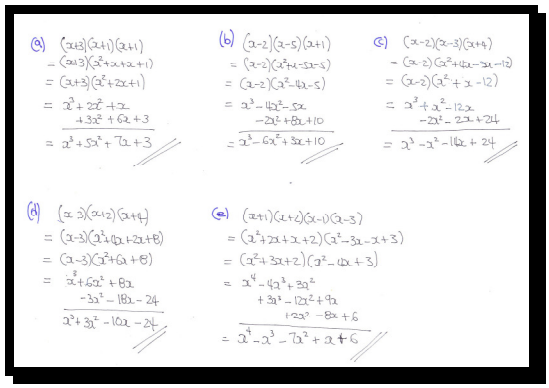
**a)** $(x+3)(x+1)(x+1)=x^3+5x^2+7x+3$

**b)** $(x-2)(x-5)(x+1)=x^3-6x^2+3x+10$

**c)** $(x-2)(x-3)(x+4)=x^3-x^2-14x+24$

**d)** $(x-3)(x+2)(x+4)=x^3+3x^2-10x-24$

**e)** $(x+1)(x+2)(x-1)(x-3)=x^4-x^3-7x^2+x+6$



## Question 10

Expand the brackets and simplify fully the following expressions.

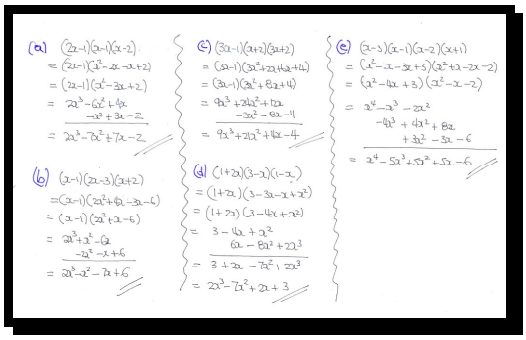
**a)** $(2x-1)(x-1)(x-2)=2x^3-7x^2+7x-2$

**b)** $(x-1)(2x-3)(x+2)=2x^3-x^2-7x+6$

**c)** $(3x-1)(x+2)(3x+2)=9x^3+21x^2+4x-4$

**d)** $(1+2x)(3-x)(1-x)=2x^3-7x^2+2x+3$

**e)** $(x-3)(x-1)(x-2)(x+1)=x^4-5x^3+5x^2+5x-6$



# QUADRATIC FACTORIZATION

**Question 11**

Factorize each of the following quadratic expressions.

**a)** $x^2-8x-9=(x+1)(x-9)$

**b)** $x^2+7x+10=(x+2)(x+5)$

**c)** $x^2-7x+12=(x-3)(x-4)$

**d)** $x^2+4x-12=(x+6)(x-2)$

**e)** $x^2+8x-20=(x+10)(x-2)$

**f)** $x^2-6x-16=(x+2)(x-8)$

**g)** $x^2-11x+24=(x-3)(x-8)$

**h)** $x^2+10x+24=(x+4)(x+6)$

**Question 12**

Factorize each of the following quadratic expressions.

**a)** $x^2+5x-6=(x+6)(x-1)$

**b)** $x^2+7x+12=(x+3)(x+4)$

**c)** $x^2+7x-18=(x+9)(x-2)$

**d)** $x^2-8x+15=(x-3)(x-5)$

**e)** $x^2-x-20=(x-5)(x+4)$

**f)** $x^2-11x+18=(x-2)(x-9)$

**g)** $x^2+x-30=(x-5)(x+6)$

**h)** $x^2-12x+20=(x-10)(x-2)$

**Question 13**

Factorize each of the following quadratic expressions.

**a)** $x^2-12x+36=(x-6)(x-6)$

**b)** $x^2+4x-12=(x-2)(x+6)$

**c)** $x^2+9x+18=(x+6)(x+3)$

**d)** $x^2+2x-15=(x-3)(x+5)$

**e)** $x^2+8x+15=(x+5)(x+3)$

**f)** $x^2-7x+12=(x-4)(x-3)$

**g)** $x^2+x-12=(x-3)(x+4)$

**h)** $x^2-8x+16=(x-4)(x-4)$

**Question 14**

Factorize each of the following quadratic expressions.

**a)** $x^2+3x-28=(x-4)(x+7)$

**b)** $x^2-2x-24=(x-6)(x+4)$

**c)** $x^2-10x+21=(x-3)(x-7)$

**d)** $x^2+14x+24=(x+2)(x+12)$

**e)** $x^2-12x+32=(x-8)(x-4)$

**f)** $x^2+13x-30=(x-2)(x+15)$

**g)** $x^2-11x+28=(x-4)(x-7)$

**h)** $x^2+12x+32=(x+8)(x+4)$

**Question 15**

Factorize each of the following quadratic expressions.

**a)** $x^2-3x-40=(x-8)(x+5)$

**b)** $x^2-14x+24=(x-2)(x-12)$

**c)** $x^2+13x+36=(x+9)(x+4)$

**d)** $x^2-17x+42=(x-3)(x-14)$

**e)** $x^2+18x+45=(x+15)(x+3)$

**f)** $x^2+14x+40=(x+10)(x+4)$

**g)** $x^2-19x+48=(x-16)(x-3)$

**h)** $x^2-8x-48=(x-12)(x+4)$

**Question 16**

Factorize each of the following quadratic expressions.

**a)** $x^2-14x+45=(x-5)(x-9)$

**b)** $x^2-15x+50=(x-5)(x-10)$

**c)** $x^2+6x-40=(x-4)(x+10)$

**d)** $x^2-30x+56=(x-2)(x-28)$

**e)** $x^2-9x-52=(x-13)(x+4)$

**f)** $x^2+4x-45=(x-5)(x+9)$

**g)** $x^2+15x+56=(x+7)(x+8)$

**h)** $x^2+37x-360=(x-8)(x+45)$

**Question 17**

Factorize each of the following quadratic expressions.

**a)** $2x^2-5x+3=(2x+1)(x-3)$

**b)** $2x^2-11x+15=(2x-5)(x-3)$

**c)** $3x^2-10x+8=(3x-4)(x-2)$

**d)** $2x^2-x-10=(2x-5)(x+2)$

**e)** $3x^2+11x+6=(3x+2)(x+3)$

**f)** $3x^2-8x+4=(3x-2)(x-2)$

**g)** $5x^2+6x-8=(5x-4)(x+2)$

**h)** $2x^2-9x-18=(2x+3)(x-6)$

**Question 18**

Factorize each of the following quadratic expressions.

**a)** $3x^2-5x-12=(3x+4)(x-3)$

**b)** $5x^2+19x-4=(5x-1)(x+4)$

**c)** $3x^2-16x+5=(3x-1)(x-5)$

**d)** $3x^2-11x+6=(3x-2)(x-3)$

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

**f)** $3x^2+x-2=(3x-2)(x+1)$

**g)** $2x^2+7x+5=(2x+5)(x+1)$

**h)** $3x^2+11x-4=(3x-1)(x+4)$

**Question 19**

Factorize each of the following quadratic expressions.

**a)** $2x^2+7x+6=(2x+3)(x+2)$

**b)** $5x^2-12x-9=(5x+3)(x-3)$

**c)** $2x^2-13x-24=(2x+3)(x-8)$

**d)** $3x^2+2x-8=(3x-4)(x+2)$

**e)** $2x^2+13x+15=(2x+3)(x+5)$

**f)** $2x^2+3x-20=(2x-5)(x+4)$

**g)** $2x^2-5x-18=(2x-9)(x+2)$

**h)** $3x^2+22x-16=(3x-2)(x+8)$

**Question 20**

Factorize each of the following quadratic expressions.

**a)** $3x^2-17x+20=(3x-5)(x-4)$

**b)** $2x^2-3x-5=(2x-5)(x+1)$

**c)** $5x^2-7x+2=(5x-2)(x-1)$

**d)** $3x^2+13x+12=(3x+4)(x+3)$

**e)** $2x^2-15x+27=(2x-9)(x-3)$

**f)** $7x^2-9x-10=(7x+5)(x-2)$

**g)** $3x^2-13x+14=(3x-7)(x-2)$

**h)** $2x^2+9x-18=(2x-3)(x+6)$

**Question 21**

Factorize each of the following quadratic expressions.

**a)** $2x^2+7x-30=(2x-5)(x+6)$

**b)** $2x^2+11x-30=(2x+15)(x-2)$

**c)** $4x^2+8x+3=(2x+1)(2x+3)$

**d)** $4x^2-11x-3=(4x+1)(x-3)$

**e)** $4x^2+4x-15=(2x+5)(2x-3)$

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

**g)** $4x^2+5x-6=(x+2)(4x-3)$

**h)** $4x^2-8x-5=(2x-5)(2x+1)$

**Question 22**

Factorize each of the following quadratic expressions.

**a)** $4x^2-5x-9=(x+1)(4x-9)$

**b)** $4x^2+16x+15=(2x+5)(2x+3)$

**c)** $4x^2-19x-5=(4x+1)(x-5)$

**d)** $4x^2-33x+8=(x-8)(4x-1)$

**e)** $4x^2+5x-9=(4x+9)(x-1)$

**f)** $4x^2-20x+9=(2x-1)(2x-9)$

**g)** $4x^2-11x-20=(4x+5)(x-4)$

**h)** $4x^2+5x-21=(4x-7)(x+3)$

**Question 23**

Factorize each of the following quadratic expressions.

**a)** $4x^2-27x+18=(4x-3)(x-6)$

**b)** $6x^2+7x-3=(2x+3)(3x-1)$

**c)** $6x^2-5x-4=(2x+1)(3x-4)$

**d)** $6x^2+19x+10=(2x+5)(3x+2)$

**e)** $6x^2+7x-10=(x+2)(6x-5)$

**f)** $6x^2-13x-15=(6x+5)(x-3)$

**g)** $6x^2-17x+10=(x-2)(6x-5)$

**h)** $6x^2-13x+6=(2x-3)(3x-2)$

**Question 24**

Factorize each of the following quadratic expressions.

**a)** $6x^2+x-12=(2x+3)(3x-4)$

**b)** $6x^2+11x-10=(2x+5)(3x-2)$

**c)** $8x^2-10x-3=(4x+1)(2x-3)$

**d)** $8x^2+14x+3=(4x+1)(2x+3)$

**e)** $8x^2-5x-3=(8x+3)(x-1)$

**f)** $8x^2-22x+5=(4x-1)(2x-5)$

**g)** $8x^2-6x-5=(2x+1)(4x-5)$

**h)** $8x^2+3x-5=(x+1)(8x-5)$

**Question 25**

Factorize each of the following quadratic expressions.

**a)** $12x^2+7x+1=(3x+1)(4x+1)$

**b)** $12x^2+4x-1=(6x-1)(2x+1)$

**c)** $12x^2+5x-3=(4x+3)(3x-1)$

**d)** $12x^2-17x+5=(12x-5)(x-1)$

**e)** $12x^2-7x-5=(12x+5)(x-1)$

**f)** $12x^2+5x-7=(x+1)(12x-7)$

**g)** $12x^2-16x+5=(2x-1)(6x-5)$

**h)** $12x^2-13x-4=(4x+1)(3x-4)$

**Question 26**

Factorize each of the following quadratic expressions.

**a)** $12x^2 - 29x - 60 = (4x - 15)(3x + 4)$

**b)** $21x^2 - 17x + 2 = (7x - 1)(3x - 2)$

# SQUARING BRACKETS

**Question 27**

Square the following brackets.

**a)** $(x+3)^2 = x^2+6x+9$

**b)** $(y-9)^2 = y^2-18y+81$

**c)** $(a+1)^2 = a^2+2a+1$

**d)** $(k-6)^2 = k^2-12k+36$

**e)** $(1+w)^2 = 1+2w+w^2$

**f)** $(2-v)^2 = 4-4v+v^2$

**Question 28**

Square the following brackets.

**a)** $(5+x)^2 = 25+10x+x^2$

**b)** $(4-b)^2 = 16-8b+b^2$

**c)** $(t+2)^2 = t^2+4t+4$

**d)** $(y-5)^2 = y^2-10y+25$

**e)** $(b+7)^2 = b^2+14b+49$

**f)** $(c-8)^2 = c^2-16c+64$

**Question 29**

Square the following brackets.

**a)** $(6+k)^2 = 36+12k+k^2$

**b)** $(3-p)^2 = 9-6p+p^2$

**c)** $(8+d)^2 = 64+16d+d^2$

**d)** $(7-m)^2 = 49-14m+m^2$

**e)** $(q+10)^2 = q^2+20q+100$

**f)** $(2n-1)^2 = 4n^2-4n+1$

**Question 30**

Square the following brackets.

**a)** $(3x+2)^2 = 9x^2+12x+4$

**b)** $(2z-3)^2 = 4z^2-12z+9$

**c)** $(4n+1)^2 = 16n^2+8n+1$

**d)** $(3p+4)^2 = 9p^2+24p+16$

**e)** $(2k-2)^2 = 4k^2-8k+4$

**f)** $(4-2n)^2 = 16-16n+4n^2$

**Question 31**

Square the following brackets.

**a)** $(3+4p)^2 = 9+24p+16p^2$

**b)** $(2y-9)^2 = 4y^2-36y+81$

**c)** $(5a+1)^2 = 25a^2+10a+1$

**d)** $(6b+2)^2 = 36b^2+24b+4$

**e)** $(4h-2)^2 = 16h^2-16z+4$

**f)** $(6-2y)^2 = 36-24y+4y^2$

**Question 32**

Square the following brackets.

**a)** $(1+4q)^2 = 1+8q+16q^2$

**b)** $(3-5k)^2 = 9-30k+25k^2$

**c)** $(7d-1)^2 = 49d^2-14d+1$

**d)** $(6x+4)^2 = 36x^2+48x+16$

**e)** $(3y-3)^2 = 9y^2-18y+9$

**f)** $(7-2w)^2 = 49-28w+4w^2$

**Question 33**

Square the following brackets.

**a)** $(8+2n)^2 = 64+32n+4n^2$

**b)** $(1-5c)^2 = 1-10c+25c^2$

**c)** $(4m-1)^2 = 16m^2-8m+1$

**d)** $(8p+1)^2 = 64p^2+16p+1$

**e)** $(6n-1)^2 = 36n^2-12n+1$

**f)** $(3m+2)^2 = 9m^2+12m+4$

**Question 34**

Square the following brackets.

**a)** $(4h-4)^2 = 16h^2-32h+16$

**b)** $(3-2x)^2 = 9-12x+4x^2$

**c)** $(1+4c)^2 = 1+8c+16c^2$

**d)** $(5-2p)^2 = 25-20p+4p^2$

**e)** $(7t+5)^2 = 49t^2+70t+25$

**f)** $(5d-2)^2 = 25d^2-20d+4$

**Question 35**

Square the following brackets.

**a)** $(3z-4)^2 = 9z^2 - 24z + 16$

**b)** $(1-7w)^2 = 1 - 14w + 49w^2$

**c)** $(2+4y)^2 = 4 + 16y + 16y^2$

**d)** $(2-6k)^2 = 4 - 24k + 36k^2$

**e)** $(5b-1)^2 = 25b^2 - 10b + 1$

**f)** $(5m-4)^2 = 25m^2 - 40m + 16$

**Question 36**

Square the following brackets.

**a)** $(8v-1)^2 = 64v^2 - 16v + 1$

**b)** $(6-2t)^2 = 36 - 24t + 4t^2$

**c)** $(9+2c)^2 = 81 + 36c + 4c^2$

**d)** $(1-10n)^2 = 1 - 20n + 100n^2$

**e)** $(4x-5)^2 = 16x^2 - 40x + 25$

**f)** $(12a+1)^2 = 144a^2 + 24a + 1$

# DIFFERENCE OF SQUARES

**Question 37**

Factorize:

**a)** $x^2-16=(x-4)(x+4)$

**b)** $25-a^2=(5-a)(5+a)$

**c)** $y^2-1=(y-1)(y+1)$

**d)** $81-b^2=(9-b)(9+b)$

**e)** $t^2-36=(t-6)(t+6)$

**f)** $64-w^2=(8-w)(8+w)$

**g)** $n^2-100=(n-10)(n+10)$

**h)** $4-d^2=(2-d)(2+d)$

**i)** $p^2-9=(p-3)(p+3)$

**j)** $49-c^2=(7-c)(7+c)$

**Question 38**

Factorize:

**a)** $36w^2 - 16 = (6w - 4)(6w + 4)$

**b)** $9x^2 - 25 = (3x - 5)(3x + 5)$

**c)** $4y^2 - 1 = (2y - 1)(2y + 1)$

**d)** $16k^2 - 81 = (4k - 9)(4k + 9)$

**e)** $25v^2 - 36 = (5v - 6)(5v + 6)$

**f)** $9w^2 - 64 = (3w - 8)(3w + 8)$

**g)** $9m^2 - 100 = (3m - 10)(3m + 10)$

**h)** $9z^2 - 4 = (3z - 2)(3z + 2)$

**i)** $16p^2 - 9 = (4p - 3)(4p + 3)$

**j)** $25c^2 - 49 = (5c - 7)(5c + 7)$

# COMPLETING THE SQUARE

## Question 39

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

**a)** $y = x^2 - 8x - 2 = (x-4)^2 - 18$ $\qquad \min(4,-18)$

**b)** $y = x^2 + 6x + 10 = (x+3)^2 + 1$ $\qquad \min(-3,1)$

**c)** $y = x^2 - 4x + 1 = (x-2)^2 - 3$ $\qquad \min(2,-3)$

**d)** $y = x^2 + 4x + 9 = (x+2)^2 + 5$ $\qquad \min(-2,5)$

**e)** $y = x^2 + 8x + 20 = (x+4)^2 + 4$ $\qquad \min(-4,4)$

## Question 40

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

**a)** $y = x^2 - 6x + 10 = (x-3)^2 + 1$ $\qquad \min(3,1)$

**b)** $y = x^2 - 10x + 24 = (x-5)^2 - 1$ $\qquad \min(5,-1)$

**c)** $y = x^2 + 10x + 30 = (x+5)^2 + 5$ $\qquad \min(-5,5)$

**d)** $y = x^2 - 12x - 4 = (x-6)^2 - 40$ $\qquad \min(6,-40)$

**e)** $y = x^2 + 14x + 29 = (x+7)^2 - 20$ $\qquad \min(-7,-20)$

## Question 41

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

**a)** $y = x^2 + 2x = (x+1)^2 - 1$ $\qquad \min(-1,-1)$

**b)** $y = x^2 - 8x = (x-4)^2 - 16$ $\qquad \min(4,-16)$

**c)** $y = x^2 - 2x + 7 = (x-1)^2 + 6$ $\qquad \min(1,6)$

**d)** $y = x^2 + 6x + 10 = (x+3)^2 + 1$ $\qquad \min(-3,1)$

**e)** $y = x^2 - 12x + 27 = (x-6)^2 - 9$ $\qquad \min(6,-9)$

## Question 42

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

**a)** $y = x^2 + 12x + 36 = (x+6)^2$ $\qquad \min(-6,0)$

**b)** $y = x^2 - 4x + 6 = (x-2)^2 + 2$ $\qquad \min(2,2)$

**c)** $y = x^2 - 16x + 40 = (x-8)^2 - 24$ $\qquad \min(8,-24)$

**d)** $y = x^2 - 8x + 18 = (x-4)^2 + 2$ $\qquad \min(4,2)$

**e)** $y = x^2 + 14x + 50 = (x+7)^2 + 1$ $\qquad \min(-7,1)$

## Question 43

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

**a)** $y = x^2 - 7x + 10 = \left(x - \frac{7}{2}\right)^2 - \frac{9}{4}$ $\qquad \min\left(\frac{7}{2}, -\frac{9}{4}\right)$

**b)** $y = x^2 + 3x + 10 = \left(x + \frac{3}{2}\right)^2 + \frac{31}{4}$ $\qquad \min\left(-\frac{3}{2}, \frac{31}{4}\right)$

**c)** $y = x^2 + x + 1 = \left(x + \frac{1}{2}\right)^2 + \frac{3}{4}$ $\qquad \min\left(-\frac{1}{2}, \frac{3}{4}\right)$

**d)** $y = 2x^2 - 8x + 10 = 2(x-2)^2 + 2$ $\qquad \min(2,2)$

**e)** $y = 3x^2 - 18x + 24 = 3(x-3)^2 - 3$ $\qquad \min(3,-3)$

## Question 44

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

**a)** $y = 4x^2 - 8x + 28 = 4(x-1)^2 + 24$ $\qquad \min(1,24)$

**b)** $y = 5x^2 + 20x + 15 = 5(x+2)^2 - 5$ $\qquad \min(-2,-5)$

**c)** $y = 3x^2 + 24x + 45 = 3(x+4)^2 - 3$ $\qquad \min(-4,-3)$

**d)** $y = 4x^2 - 8x + 16 = 4(x-1)^2 + 12$ $\qquad \min(1,12)$

**e)** $y = 5x^2 + 10x = 5(x+1)^2 - 5$ $\qquad \min(-1,-5)$

## Question 45

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

**a)** $y=-x^2+4x-3=1-(x-2)^2$ $\qquad$ $\max(2,1)$

**b)** $y=-x^2-12x-32=4-(x+6)^2$ $\qquad$ $\max(-6,4)$

**c)** $y=-x^2-6x-7=2-(x+3)^2$ $\qquad$ $\max(-3,2)$

**d)** $y=-x^2+14x=49-(x-7)^2$ $\qquad$ $\max(7,49)$

**e)** $y=-x^2+2x-15=-14-(x-1)^2$ $\qquad$ $\max(1,-14)$

## Question 46

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

**a)** $y=-2x^2+12x+36=54-2(x-3)^2$ $\qquad$ $\max(3,54)$

**b)** $y=-4x^2+4x-3=-2-4\left(x-\frac{1}{2}\right)^2$ $\qquad$ $\max\left(\frac{1}{2},-2\right)$

**c)** $y=-x^2-x-2=-\frac{7}{4}-\left(x+\frac{1}{2}\right)^2$ $\qquad$ $\max\left(-\frac{1}{2},-\frac{7}{4}\right)$

**d)** $y=-x^2-3x+\frac{1}{4}=\frac{5}{2}-\left(x+\frac{3}{2}\right)^2$ $\qquad$ $\max\left(-\frac{3}{2},\frac{5}{2}\right)$

**e)** $y=-2x^2+\frac{1}{2}x-\frac{9}{8}=-\frac{35}{32}-2\left(x-\frac{1}{8}\right)^2$ $\qquad$ $\max\left(\frac{1}{8},-\frac{35}{32}\right)$

# REARRANGE FORMULAE

## Question 47

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

**a)** $v = u + at \quad [a]$ (*) $\boxed{a = \dfrac{v-u}{t}}$

**b)** $y = 2x + 3 \quad [x]$ (*) $\boxed{x = \dfrac{y-3}{2}}$

**c)** $y = bt - 3 \quad [t]$ (*) $\boxed{t = \dfrac{y+3}{b}}$

**d)** $A = \pi r^2 \quad [r]$ (*) $\boxed{r = \pm\sqrt{\dfrac{A}{\pi}}}$

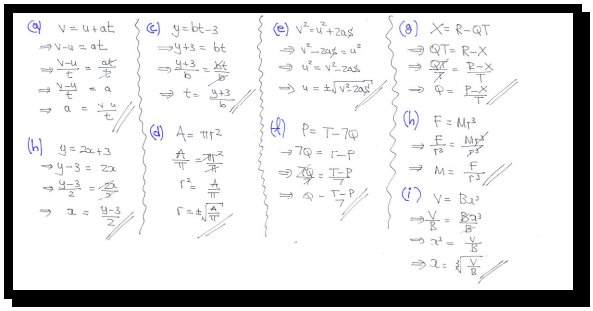
**e)** $v^2 = u^2 + 2as \quad [u]$ (*) $\boxed{u = \pm\sqrt{v^2 - 2as}}$

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

**g)** $X = R - QT \quad [Q]$ (*+) $\boxed{Q = \dfrac{R-X}{T}}$

**h)** $F = Mr^3 \quad [M]$ (*+) $\boxed{M = \dfrac{F}{r^3}}$

**i)** $V = Bx^3 \quad [x]$ (*+) $\boxed{r = \sqrt[3]{\dfrac{V}{B}}}$



## Question 48

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

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

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

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

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

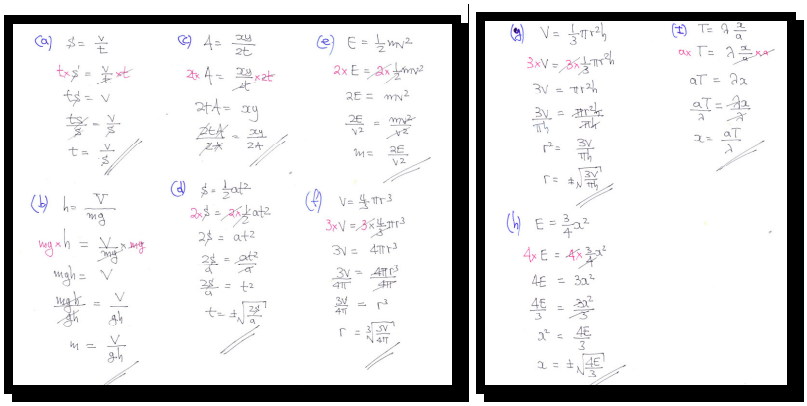
**e)** $E=\dfrac{1}{2}mv^2\quad [m]$ (*+) $\boxed{m=\dfrac{2E}{v^2}}$

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

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

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

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



## Question 49

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

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

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

**c)** $\sqrt{y}=2x \quad [y]$ (**+) $\boxed{y=4x^2}$

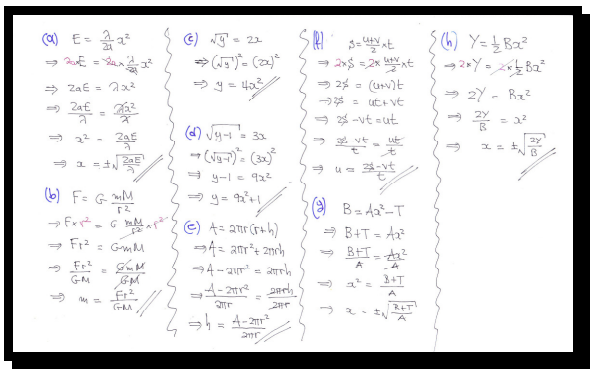
**d)** $\sqrt{y-1}=3x \quad [y]$ (**+) $\boxed{y=9x^2+1}$

**e)** $A=2\pi r\left(r+h\right) \quad [h]$ (**+) $\boxed{h=\dfrac{A}{2\pi r}-r=\dfrac{A-2\pi r^2}{2\pi r}}$

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

**g)** $B=Ax^2-T \quad [x]$ (***) $\boxed{x=\pm\sqrt{\dfrac{B+T}{A}}}$

**h)** $Y=\frac{1}{2}Bx^2 \quad [x]$ (***) $\boxed{x=\pm\sqrt{\dfrac{2Y}{B}}}$



## Question 50

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

**a)** $v^2=\omega^2\left(a^2-x^2\right)\quad[x]$ (***) $\boxed{x=\pm\sqrt{a^2-\frac{v^2}{\omega^2}}=\pm\sqrt{\frac{a^2-v^2}{\omega^2}}}$

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

**c)** $2\pi rh+\pi r^2=600\quad[h]$ (***) $\boxed{h=\frac{600-\pi r^2}{2\pi r}}$

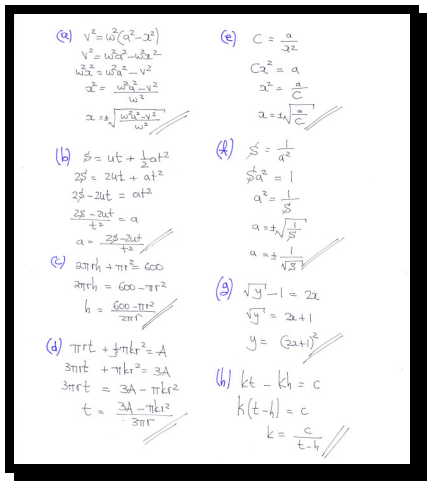
**d)** $\pi rt+\frac{1}{3}\pi kr^2=A\quad[t]$ (***) $\boxed{t=\frac{3A-\pi kr^2}{3\pi r}}$

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

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

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

**h)** $kt-kh=c\quad[k]$ (***) $\boxed{k=\frac{c}{t-h}}$



## Question 51

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

**a)** $2R+QR=QT \quad [R]$ (***) $\boxed{R=\dfrac{QT}{Q+2}}$

**b)** $2R+QR=QT \quad [Q]$ (***+) $\boxed{Q=\dfrac{2R}{T-R}}$

**c)** $2x-5y=y-mx \quad [x]$ (***+) $\boxed{x=\dfrac{6y}{m+2}}$

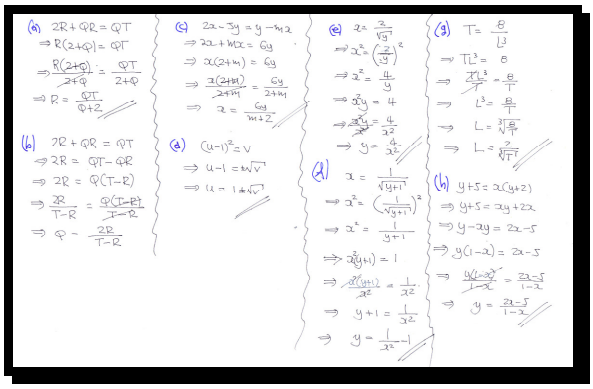
**d)** $(u-1)^2=v \quad [u]$ (***+) $\boxed{u=\pm\sqrt{v}+1}$

**e)** $x=\dfrac{2}{\sqrt{y}} \quad [y]$ (***+) $\boxed{y=\dfrac{4}{x^2}}$

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

**g)** $T=\dfrac{8}{L^3} \quad [L]$ (***+) $\boxed{L=\dfrac{2}{\sqrt[3]{T}}}$

**h)** $y+5=x(y+2) \quad [y]$ (****) $\boxed{y=\dfrac{2x-5}{1-x}}$



## Question 52

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

**a)** $y=\dfrac{x+a}{x+b}\quad [x]$ (****) $\boxed{x=\dfrac{a-by}{y-1}}$

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

**c)** $T=\dfrac{Q}{Q+2}\quad [Q]$ (****) $\boxed{Q=\dfrac{2T}{1-T}}$

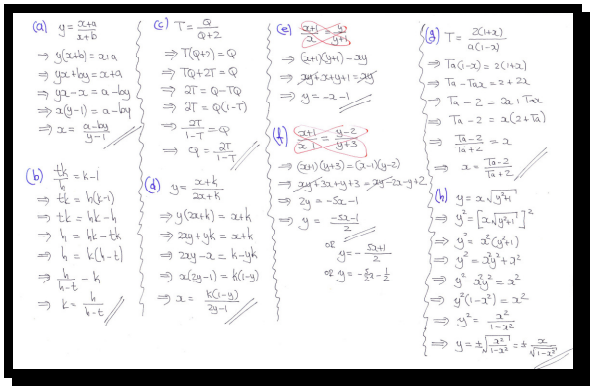
**d)** $y=\dfrac{x+k}{2x+k}\quad [x]$ (****) $\boxed{x=\dfrac{k(y-1)}{1-2y}=\dfrac{k(1-y)}{2y-1}}$

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

**f)** $\dfrac{x+1}{x-1}=\dfrac{y-2}{y+3}\quad [y]$ (****) $\boxed{y=\dfrac{-5x-1}{2}}$

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

**h)** $y=x\sqrt{y^2+1}\quad [y]$ (****+) $\boxed{y=\pm\dfrac{x}{\sqrt{1-x^2}}}$



## Question 53

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

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

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

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

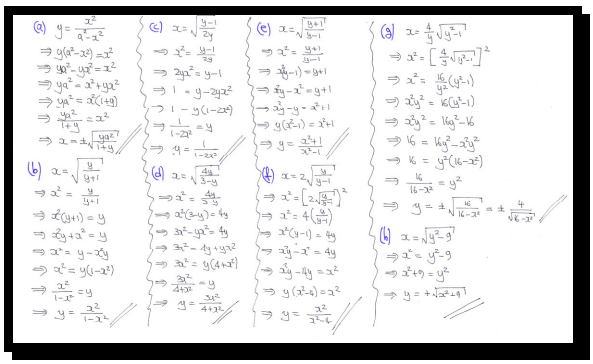
**d)** $x=\sqrt{\dfrac{4y}{3-y}}$ $[y]$ (****+) $\boxed{y=\dfrac{3x^2}{x^2+4}}$

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

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

**g)** $x=\dfrac{4}{y}\sqrt{y^2-1}$ $[y]$ (****+) $\boxed{y=\pm\dfrac{4}{\sqrt{16-x^2}}}$

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



## Question 54

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

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

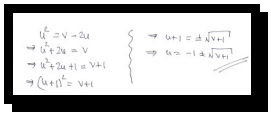
**b)** $T=2\pi\sqrt{\dfrac{L}{g}}\quad [L]$ (****+) $\boxed{L=\dfrac{gT^2}{4\pi^2}}$

**c)** $V=\dfrac{1}{3}\pi r^2\sqrt{L^2-r^2}\quad [L]$ (****+) $\boxed{L=\sqrt{r^2+\dfrac{9V^2}{\pi^2 r^4}}}$

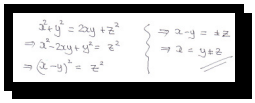
**d)** $A=\dfrac{1}{2}h(a+b)+\dfrac{1}{2}b(a+h)\quad [a]$ (****+) $\boxed{a=\dfrac{2(A-hb)}{h+b}}$

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

**f)** $u^2=v-2u\quad [u]$ (*****) $\boxed{u=-1\pm\sqrt{v+1}}$



**g)** $x^2+y^2=2xy+z^2\quad [x]$ (*****) $\boxed{x=y\pm z}$



**h)** $x+\sqrt{x}=y\quad [x]$ (*****) $\boxed{x=y+\dfrac{1}{2}\left[1\pm\sqrt{4y+1}\right]}$

