

# WE LOVE ALGEBRA

## A. ALGEBRAIC EXPRESSIONS

### QUICK NOTES:

#### A. Expansion of algebraic expression

- $a(x + y) = ax + ay$
- $(x + y)^2 = (x + y)(x + y) = x^2 + 2xy + y^2$
- $(x - y)^2 = (x - y)(x - y) = x^2 - 2xy + y^2$
- $(x + y)(x - y) = x^2 - y^2$

#### B. Factorisation of algebraic expression

##### a. Common Factor

$$4p^2q - 6pq^3 = 2pq(2p - 3q^3)$$

##### b. Difference of two squares

$$x^2 - y^2 = (x + y)(x - y)$$

##### c. Quadratic Expression

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

##### d. Factorisation by grouping

$$ab + ad + bc + cd = a(b + d) + c(b + d) = (b + d)(a + c)$$

1. Simplify each of the following algebraic expressions:

- $20(abc^2 + 4)$
- $-6(pq^2 + 3rs - 2t^2)$
- $(12xy - 36z^2 + 54rs) \div 6$
- $\frac{8def - 28e^2f + 20jk}{-4}$
- $3(2x - 2y) - 5(x - 3y)$
- $4 - (x - 2)(x + 2)$
- $(2d - 3e)^2 + 12de$
- $(3x - y)(x + 2y) + 2y^2$
- $4a^2 - (2a - b)^2$
- $p(p - 2q) - (p + 2q)^2$
- $(x + y)^2 - (x - y)^2$
- $4x(x - 2y) - (4x - y)^2$
- $(2p - q)(p + q) - 2p(p + q)$
- $(2w + v)^2 - 2w(w + v)$
- $\frac{r^3s + 3rs}{r^2s}$

2. Factorise completely:

- $3x^2 - 27x$
- $4m^2n - 12mn^2$
- $(1 - x)^2 - (1 - x)$
- $4x^2 - 4x + 1$
- $2p^2 + 9p - 5$
- $2h^2 - 5h - 12$
- $4x^2 - 10x - 6$
- $4x^2 - 8x + 4$
- $4p^2 - 9$
- $81 - 4x^2$
- $3m^2 - 12n^2$
- $x^2y^2 - y^4$

1. Express  $\frac{3}{5r} - \frac{1+15s}{25rs}$  as a single fraction in its simplest form.
2. Express  $\frac{1}{p-3} - \frac{2p+1}{(p-3)(p+4)}$  as a single fraction in its simplest form.
3. Express  $\frac{3}{5x} - \frac{2-x}{20x^2}$  as a single fraction in its simplest form.
4. Express  $\frac{2}{9k} - \frac{3-h}{3hk}$  as a single fraction in its simplest form.
5. Express  $\frac{2}{5e} - \frac{4+h}{15eh}$  as a single fraction in its simplest form.
6. Express  $\frac{2}{5e} - \frac{4+h}{15eh}$  as a single fraction in its simplest form.
7. Express  $\frac{1}{3r} - \frac{5+s}{15rs}$  as a single fraction in its simplest form.
8. Express  $\frac{p+5}{4p} - \frac{2-p}{p}$  as a single fraction in its simplest form.
9. Express  $\frac{4}{3p} - \frac{p-7}{6p^2}$  as a single fraction in its simplest form.
10. Express  $\frac{5}{y} + \frac{3}{y+3}$  as a single fraction in its simplest form.
11. Express  $\frac{2(p-3)}{pq} - \frac{6-q}{3q}$  as a single fraction in its simplest form.
12. Express  $\frac{6}{7h} - \frac{k-3}{2hk}$  as a single fraction in its simplest form.
13. Express  $\frac{p+2}{3p} - \frac{q-3p}{pq}$  as a single fraction in its simplest form.

## A. ALGEBRAIC FORMULAE

### QUICK NOTES:

#### A. Formulae

A formula is an equation which expresses the relation between two or more variables.

Examples:  $p = 2(l + b)$

#### B. Subject of a formula

The subject of a formula is the variable which is expressed in terms of other variables.

For example, in the formula

$$A = \frac{1}{2}(a + b) \times t$$

A is the subject of the formula as it is expressed in terms of a, b and t.

#### C. Change the subject of a formula is done by rearranging the formula so that another variable become the subject of the formula

1. Given  $y = \frac{2u}{3-u}$ , express  $u$  in terms of  $y$ .
2. Given  $1 + p = \frac{4-2q}{3}$ , express  $q$  in terms of  $p$ .
3. Given that  $\frac{p}{2} = \frac{3p-1}{\sqrt{k}}$ , express  $k$  in terms of  $p$ .
4. Given  $y = \frac{2u}{3-u}$ , express  $u$  in terms of  $y$ .
5. Given  $y = \frac{2}{x} + 3$ , express  $x$  in terms of  $y$ .
6. Given  $x(y + 2) = 3x + y$ , express  $y$  in terms of  $x$ .
7. Given  $x^2 + y^2 - 4 = 0$ , express  $y$  in terms of  $x$ .
8. Given  $k = \frac{r}{r-2}$ , express  $r$  in terms of  $k$ .
9. Given  $y = \frac{2}{x} + \frac{1}{2x}$ , express  $x$  in terms of  $y$ .
10. Given  $2mn + m = n$ , express  $n$  in terms of  $m$ .
11. Given  $m + 2 = \frac{n}{s}$ , express  $s$  in terms of  $m$  and  $n$ .
12. Given  $T = 4\sqrt{h} + 2$ , express  $h$  in terms of  $T$ .

## B. LINEAR EQUATIONS

### QUICK NOTES:

- A. To solve a linear equation is to find the value of the value of the unknown which satisfies the equation.
- B. To find the value of  $x$ , use the inverse operation to reduce the given equation to  $x = a$  where  $a$  is the value of  $x$ .

For example,

The inverse of -1 is +	The inverse of + is -	The inverse of $\times$ is $\div$	The inverse of $\div$ is $\times$
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Solve the following equations.

1.  $\frac{2}{3}x + 2 = 20$
2.  $2 - x = 10 + x$
3.  $5 - \frac{1}{3}p = p + 1$
4.  $2(y + 1) - (1 - 2y) = 13$
5.  $\frac{2}{5}x = \frac{1}{2}x - 1$
6.  $4(1 + y) - 2(3 - y) = 22$

7.  $2k = 9 - k$
8.  $5f - 3(1 - f) = 13$
9.  $5p - 2 = 4p + 3$
10.  $\frac{m+2}{3} - \frac{m}{2} = 3$
11.  $2p + 3 = 10 + p$
12.  $\frac{7x-5}{4} = 11$
13.  $(6v - 7) - (8 - 2v) = 1$
14.  $\frac{x}{2} + \frac{x}{3} = 10$
15.  $\frac{2x-3}{2} = 2x - 1$
16.  $4(2d + 3) = 3d + 2$
17.  $\frac{w}{2} = \frac{4}{3}$
18.  $\frac{3}{5}y + 3 = 5$

### C. SIMULTANEOUS LINEAR EQUATIONS

#### QUICK NOTES:

##### Elimination Method

- a) Make the coefficients of a pair of corresponding like terms in the equation the same.
  - i. Signs of the coefficients of two equal unknowns are opposite  
**"Add the two equations"**
  - ii. Signs of the coefficients of the two equal unknowns are the same  
**"Subtract one equation from the other"**
- b) Find the value of one unknown.
- c) Substitute the value into one of the equations to find the value of the other unknown.

##### Substitution Method

- a. In one of the equations, express one unknown in terms of the other unknown.
- b. Substitute the equation into the other equation to form a linear equation in one unknown.
- c. Solve the equation to find the value of the unknown.
- d. Substitute the value into the equation used earlier to find the value of the second unknown.

1. Calculate the values of h and k that satisfy the following simultaneous linear equations:

$$\begin{aligned} h - 4k &= 2 \\ 2h - k &= 18 \end{aligned}$$

2. Calculate the values of p and q that satisfy the following simultaneous linear equations:

$$\begin{aligned} 3p + q &= 2 \\ 2p - 3q &= 5 \end{aligned}$$

3. Calculate the values of r and s that satisfy the following simultaneous linear equations:

$$\begin{aligned} 3r + 5s &= 1 \\ \frac{1}{2}r - 2s &= 3 \end{aligned}$$

4. Calculate the values of v and w that satisfy the following simultaneous linear equations:

$$2v + 3w = 3$$

$$v - 6w = 9$$

5. Calculate the values of  $m$  and  $n$  that satisfy the following simultaneous linear equations:

$$4m + n = 16$$

$$m - \frac{1}{2}n = 7$$

6. Calculate the values of  $h$  and  $k$  that satisfy the following simultaneous linear equations:

$$h - 2k = 7$$

$$2h + k = 4$$

7. Calculate the values of  $d$  and  $e$  that satisfy the following simultaneous linear equations:

$$d - \frac{3}{4}e = 12$$

$$4d + 2e = 8$$

8. Calculate the values of  $n$  and  $m$  that satisfy the following simultaneous linear equations:

$$4n + \frac{1}{3}m = 7$$

$$2n - m = 7$$

9. Calculate the values of  $h$  and  $k$  that satisfy the following simultaneous linear equations:

$$8h - k = 5$$

$$2h + 3k = -2$$

10. Calculate the values of  $r$  and  $s$  that satisfy the following simultaneous linear equations:

$$r - \frac{1}{4}s = 8$$

$$4r + 3s = 0$$

11. Calculate the values of  $x$  and  $y$  that satisfy the following simultaneous linear equations:

$$2x - 3y = 7$$

$$4x + y = 0$$

12. Calculate the values of  $v$  and  $w$  that satisfy the following simultaneous linear equations:

$$4v + 3w = 11$$

$$2v - w = 13$$

13. Calculate the values of  $h$  and  $k$  that satisfy the following simultaneous linear equations:

$$\frac{1}{2}h - 2k = 3$$

$$3h - 4k = -6$$

14. Calculate the values of  $x$  and  $y$  that satisfy the following simultaneous linear equations:

$$x + 3y = -18$$

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

15. Calculate the values of  $x$  and  $y$  that satisfy the following simultaneous linear equations:

$$6x + y = 2$$

$$3x + 2y = 7$$