Algebra GCSE

Learn the basic

Basic Knowledge need to master the Algebra

- Factors, LCM & HCF
- All four operations with Negative numbers and Two signs Together
- BODMAS/ BIDMAS
- Lows of indices:
- Multiplying, Dividing, power of power, to the power 1, power 0, 1 to any power, fraction, negative power, Fractional power/ roots, two stage fractional power

Factors LCM & HCF

1) What is the sixth multiple of 4?

2) List all the factors of 36

3) How many factors 12 has?

4) Write down 36 and 24 as product of their prime numbers. Hence or otherwise find the HCF and LCM of 36 and 24

5) Use Venn diagram to find the HCF and LCM of 15, 18 & 24

All four operations with Negative numbers and Two signs Together

1) 8 - 3 =
2) 6 + 7 =
3) -8 + 6 =
4) - 4 - 6 =
5) -9 +3 - 2 =
6) -3 + 12 =
7) -3 - (-3) =
8) 3 + -9 =
9) -9 + 12 - 3 =
10) -13 - -5 =

1) 3 x 5 =
2) -3 x -4 =
3) -3 x 5 =
4) 5 x (-4) x -5 =
5) 8 x -5 =
6) 15 ÷ 3 =
7) -24 ÷ (-4) =
8) -15 ÷ 3 =
9) 20 ÷ (-3) =
10) 24 ÷ (-6) x (-5) =

+	X	+	=	+
-	X	-	=	+
-	X	+	=	-
+	X	-	=	-

BIDMAS/ BODMAS

Solve the following:

1) $12 + 23 - 5 \times 6 =$
2) $5 - 2 \times (4 + 6) =$
3) $6 \times 3 + 2 \times 3 =$
4) $2^2 + 5 - 3 \times 2 =$
5) $8 + 3 \times (9 - 12) - 4 =$
6) $10 + 5 - 12 \div 3 =$
7) $5^2 \times 2 + 5 \div 5 =$
8) $4 \times 5 + (3 + 1)^3 =$
9) $5 - 3 \times 4 =$
10) $10 - (3^2 - 2^2) \div 5 =$

Laws Of Indices

1) $a^3 \times a^5 =$
2) $2a^2 \times a^4 =$
3) $3^2 \times 3^3 =$
4) $3a^5 \times 2a^2 =$
5) $y^2 \times y^3 =$
6) $a^6 \div a^3 =$
7) $6m^6 \div 3m^2 =$
8) $a^8 \div a^2 =$
9) $(a^3)^2 =$
10) $(y^2)^2 =$
11) $(2^3)^2 =$
12) $3^1 =$
13) $a^0 =$
14) $y^0 =$
15) $4^{1/2} =$
16) $27^{1/3} =$
17) $8^{2/3} =$
18) $a^{-3} =$
19) $3^{-2} =$
20) $125^{1/3} =$

$a^m \times a^n = a^{m+n}$

$a^m \div a^n = a^{m-n}$

$(a^m)^n = a^{m \times n}$

$a^1 = a$

$a^0 = 1$

$$a^{-n} = \frac{1}{a^n}$$

$$a^{1/n} = \sqrt[n]{a}$$

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$

$a^{m/n} = (\sqrt[n]{a})^m$

Algebra Basic

- Multiplying letters and/or numbers together
- Terms - number or letter or numbers and letters multiplied together
- Expression - Terms combined together using one or more of the four operations.
- Substitution

Multiplying Letters & numbers Together

1) $a \times a =$
2) $2 \times a =$
3) $2 \times a \times b =$
4) $a \times a \times a \times a =$
5) $a + a + a + a + a =$
6) $2 \times a \times b \times c \times 3 =$
7) $ab \times ab =$
8) $(-a) \times (-b) \times (-c) =$
9) $2 \times (-a)^2 =$
10) $ab \times a \times b =$

$2a = a + a = 2 \times a$
$ab = a \times b$
$2ab = 2 \times a \times b = ab + ab$
$2a^2 = 2 \times a \times a = a^2 + a^2$
$(-a)^2 = a^2$
$-8^2 = -64$

Terms & Expression

Terms - number or letter or numbers and letters multiplied together

Ex: 2 , a , x, 2a, 6abc, $2am^2$, ab^2c^3,

- Expression - Terms combined together using one or more of the four operations.

Ex: a + 2

$2a - 3b + 2am^2$

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

Substitution

a = 2, b = 1 , c = -2 , d = 5

Find the value of the following expressions:

1) a + 2 =
2) a + b + d =
3) 2b - 5 + c =
4) Aa + 3(c - a) =
5) c^2 + 3 - b =
6) d^2 - c + 2ac =
7) Exam Question:

$f = 3g + 7h$

Work out the value of f when $g = -5$ and $h = 2$

The body mass index, B, for a person of mass m kg and height h metres is given by the formula

$$B = \frac{m}{h^2}$$

Usman has a mass of 50 kg.
He has a height of 1.57 m.

(a) Work out Usman's body mass index.
Give your answer correct to one decimal place.

Simplifying Algebraic Expression

- Collecting like terms - adding or subtracting
- Expanding Brackets
- Multiplying - Double and triple brackets

Collecting like terms - adding or subtracting

1) $a + a + a =$

2) $a + 2b + a - b =$

3) $2a + c - 3a + 2b - 5 =$

4) $3a + a^2 + 2a^2 - 5a + 6$

5) $2a - ab + a^2 - 5ab - a + 3ab =$

Expanding Brackets

1) $3(a - 3)$
2) $a(a - b)$
3) $a(a^2 - 3a + 5)$
4) $x(3x - 2y - 2)$
5) $2a(2a - 3b + 5)$

Multiplying Two Brackets

1) $(x + 2)(x + 3)$
2) $(a + 3)(a - 5)$
3) $(2a - 3)(a - 6)$
4) $(3a - 2)(5a + 4)$
5) $(2a - b)(a + 2)$
6) $3(x + 2)(2x - 5)$

7) $(x + 2)(x - 3)(2x + 5)$

8) $(2a - 1)(a + 2)(a - 1)$

Exam Question

30 Expand and simplify fully $4(2c + 3) - (5c - 1)$

[2 marks]

Answer _____

Expand and simplify fully $4(2c + 3) - (5c - 1)$

[2 marks]

Answer _____

Factorising

- Factorising Algebraic expressions
- Factorising the difference of two squares
- Factorising Quadratic when a=1

Factorising Algebraic Equation

1. Find the highest common factor of each of the terms in the expression.
2. Write the highest common factor (HCF) in front of any brackets.
3. Fill each term inside the bracket by dividing each term by the HCF

Questions: Factorise the following expression

1. Factorize the following algebraic expressions:

   (a) $6x + 24$

   (b) $8x^2 - 4x$

   (c) $6xy + 10x^2y$

   (d) $m^4 - 3m^2$

   (e) $6x^2 + 8x + 12yx$

1) $2a + 4b - 6c$
2) $2a - ab + 3ac$
3) $4a^3 + 3a^2$

Factorising the difference of two squares

1) $x^2 - y^2$
2) $4a^2 - c^2$
3) $9x^2 - 16b^2$

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

21) $y^2 - x^2$

22) $121y^2 - 36x^2$

23) $9u^2 - 4v^2$

24) $64a^2 - 25b^2$

25) $144x^2 - 25y^2$

26) $25u^2 - v^2$

27) $121x^2 - 9y^2$

28) $49x^2 - 4y^2$

29) $81x^2 - 121y^2$

30) $36x^2 - y^2$

Factorising Quadratic when a=1

Find a factor pair of c that can add up to get b.

$x^2 + bx + c$

1) $x^2 + 5x + 6$
2) $x^2 + 7x + 12$
3) $x^2 - 6x + 8$
4) $x^2 - 5x + 4$
5) $x^2 + 8x - 33$
6) $x^2 + 4x - 32$
7) $x^2 - 7x - 8$
8) $x^2 - 2x - 48$
9) $x^2 + x - 20$
10) $x^2 - 3x - 28$

Solving Equations

- Linear equation
- Quadratic Equations

Solving Linear Equation

1) $5 + \square = 8$

2) $18 - \square = 7$

3) $2 + x = 6$

4) $y + 5 = 12$

5) $2x + 5 = 13$

6) $3y - 7 = 5$

Expand and solve the following:

7) $2(3y + 20) = 70$

8) $3(4x -12) = 24$

9) $4(x + 3) = 28$

10) $3x + 8 = x - 4$

Quadratic Equation

1) $x^2 + 5x + 6 = 0$

2) $x^2 + 7x + 12 = 0$

3) $x^2 - 6x + 8$

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

5) $x^2 + 8x - 33 = 0$

6) $x^2 + 4x - 32$

7) $x^2 - 7x - 8 = 0$

8) $x^2 - 2x - 48 = 0$

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

10) $x^2 - 3x - 28 = 0$

11) $a^2 + 8a - 48 = 0$

12) $b^2 - 8b + 12 = 0$