Handout for Gr 9 workshop on 30 March

Thursday, 30 April 2026 06:02

Handout for Gr 9 w...

$5^3 = 5 \times 5 \times 5$ $g^4 = g \times g \times g \times g$

Grade 9 Mathematics

Revision workshop on 30th April 2026

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inspired by the love of Christ

Exponents a^b a is the base and b is the exponent (power or index)

Exponents come first! $2 \times 3^2 = 18$ *NOT* 36 ✓ ✗

$-2^2 = -4$ *NOT* 4 ✓ ✗

$(-2)^2 = 4$

Where a number does not have a power, it is an invisible 1, e.g., $5 = 5^1$

Rules and definitions	English	Examples
a^b means a factors of b **multiplying** together	→	$b^4 = b \times b \times b \times b$ $5^3 = 5 \times 5 \times 5$
✱ $a^b \times a^c = a^{b+c}$	When we multiply nos. with same base we ADD their exponents	$a^3 \times a^4$ $= a \times a \times a \times a \times a \times a \times a = a^7$
$\frac{a^b}{a^c} = a^b \div a^c = a^{b-c}$	When we divide nos. with same base we Subtract their exponents	$\frac{c^5}{c^2} = \frac{\cancel{c} \times \cancel{c} \times c \times c \times c}{\cancel{c} \times \cancel{c}}$ $= c^3$
$(ab)^c = a^c b^c$ but note that: $(a+b)^2 \neq a^2 + b^2$	When a product is raised to a power ALL factors get raised to the power	$(xy)^2 = (xy)(xy)$ $= xxyy$ $= x^2y^2$
$\left(\frac{a}{b}\right)^c = \frac{a^c}{b^c}$	When a fraction is raised to a power TOP AND bottom get power	$\left(\frac{a}{b}\right)^3 = \frac{a}{b} \times \frac{a}{b} \times \frac{a}{b}$ $= \frac{a^3}{b^3}$
$(a^b)^c = a^{bc}$	When a power is raised to a power we MULTIPLY powers	$(a^3)^2 = a^3 a^3$ $= a^6$
$a^0 = 1$	Any number to power 0 = 1	$\frac{a^5}{a^5} = a^0 = 1$
$a^{-b} = \frac{1}{a^b}$	When a base goes from top ⇔ bottom sign exponent changes	$\frac{g^4}{g^6} = \frac{1}{g^2} = g^{-2}$ $g^{-4} = \frac{1}{g^4}$

$2^3 \times 2^2$
 $= 2^5$ →

$\frac{4}{10} = \frac{2}{5}$

sign exponent changes $g^{-4} = \frac{1}{g^4}$

Simplify expressing your answers with positive exponents where necessary:

1. $a^5 \times a^3$

$= a^8$

2. $3^7 \times 3^5$

$= 3^{12}$

3. $2x^2y^5 \times 3x^4y^1$

$= 6x^6y^6$

4. $\frac{a^5}{a^3}$

$= a^2$

5. $\frac{7^{12}}{7^3}$

$= 7^9$

6. $\frac{12x^7}{4x^9}$

$= 3x^{-2}$

$= \frac{3}{x^2}$

$\frac{\cancel{12}^{3} \cancel{x}\cancel{x}\cancel{x}\cancel{x}\cancel{x}\cancel{x}\cancel{x}}{\cancel{4}_{1} \cancel{x}\cancel{x}\cancel{x}\cancel{x}\cancel{x}\cancel{x}\cancel{x} x x}$

7. $3(x^2)^3 \times 4x$

$= 3x^6 \times 4x^1$

$= 12x^7$

8. $\frac{(x^2y)^4 \times x^3y^5}{x^{13}y^9}$

$= \frac{x^8y^4 \times x^3y^5}{x^{13}y^9}$

$= \frac{x^{11}y^9}{x^{13}y^9} = x^{-2}y^0$

$= \frac{1}{x^2}$

9. $\frac{(x^2y)^3 \times 2xy}{x^2y^6 \times 4x^4y}$

$= \frac{x^6y^3 \times 2x^1y^1}{4x^2y^7}$

$= \frac{2x^7y^4}{4x^2y^7}$

$= \frac{1}{2} \times x^5 \times y^{-3}$

$= \frac{x^5}{2y^3}$

10. $\frac{(4x^4)^2}{8x^6}$

$4x^4 \times 4x^4$

$= \frac{16x^8}{8x^6}$

$= 2x^2$

11. $(4x^4y^7)^0 \times \left(\frac{2x}{3y^2}\right)^2$

$= 1 \times \frac{4x^2}{9y^4}$

$= \frac{4x^2}{9y^4}$

12. $3^2 + 3 + 3^0 + 3^{-1}$

$= 9 + 3 + 1 + \frac{1}{3^1}$

$= 13\frac{1}{3}$

13. $\left(\frac{x^2}{y^5}\right)^3 \times \left(\frac{y^4}{x^5}\right)^{-1}$

$\frac{x^6}{y^{15}} \times \frac{y^{-4}}{x^{-5}}$

$x^{6-(-5)} \; y^{-4-15}$

$x^{11} y^{-19} = \frac{x^{11}}{y^{19}}$

$\frac{x^6 x^5}{y^{15} y^4} = \frac{x^{11}}{y^{19}}$

14. $\frac{(2a^3b^2)^3 \times 3a^2b}{6a^2b^{-3} \times 4a^5b^{-4}}$

$\frac{8a^9b^6 \times 3a^2b}{24a^7b^{-7}} = \frac{24a^{11}b^7}{24a^7b^{-7}}$

$= a^4b^{14}$

$\boxed{15:22}$

Converting English to Maths!

The power of algebra lies in our ability to take “real world” situations and express them mathematically.

Let’s try some examples:

a. In a class there are p boys and there are 5 more girls than boys. How many girls are there?

4
10
1

$\boxed{p+5}$

$4 + 5 = 9$
$10 + 5 = 15$
$1 + 5 = 6$

b. Give a number that is 3 less than x.

8
11

$\boxed{x-3}$

$8 - 3 = 5$
$11 - 3 = 8$

c. A hamburger costs twice as much as a coke. If a coke costs c then how much will a hamburger cost?

8

2×8

$\boxed{2 \times c = 2c}$

d. If there are b boys in a class and g girls then how many children are there altogether?

10 20 30

$\boxed{b+g}$

e. If a packet of chips costs p cents and I want to buy n packets then how much will I spend?

20 4 $20 \times 4 = 80$

$p \times n$ OR $n \times p$

pn np ✓

f. A coke costs twice as much as a chocolate. If the coke costs g then what does the chocolate cost?

5

$\boxed{\frac{g}{2}}$ ✓

10

$g \div 2$

g. A boy is five years older than his sister. If he is j years old then how old is his sister?

11

6

$\boxed{j-5}$

h. There are 3 tennis balls in a tin. If I have t tins then how many tennis balls do I have?

10

$3 \times 10 = 30$

$3 \times t = 3t$

i. I have b brothers and s sisters. Express algebraically if:

a. The number of siblings I have

$b+s$ or $s+b$

b. The number of children in my family

$b+s+1$ mina

j. I am currently m years old, and my friend is currently f years old.

a. How old will I be in 5 years' time?

$m+5$

b. How old will my friend be in 5 years' time?

$f+5$

c. What will be the sum of our ages in 5 years' time?

$m+f+10$

$2 \times 7 = 14$ ✓

d. How old was I 3 years ago?

$2(4+3) = 8+6$

$= 14$ ✓

$m-3$

e. Double my age in 5 years' time

$2m+10$

k. How many days are there in n weeks and p days?

10 3

$7n+p$

$10 \times 7 + 3$

73

Substituting values into algebraic expressions

We need to learn to evaluate algebraic expressions when given the values of the variables in them.

This is an excellent opportunity to practise our integer work as well as our general number skills!

Let's start by doing some examples together:

If $x = 2$ and $y = 5$ then evaluate (determine the value of):

$2x + 3y$

$= 2(2) + 3(5)$

$= 4 + 15$

$= \underline{19}$

$3x - 2y$

$= 3(2) - 2(5)$

$= 6 - 10$

$= \underline{-4}$

x^2y

$= 2^2 \times 5$

$= 4 \times 5$

$= \underline{20}$

xy^2

$= 2 \times 5^2$

$= 2 \times 25$

$= \underline{50}$

It can get a little more interesting if we substitute negative numbers:

If $x = -2$ and $y = -3$ then evaluate (determine the value of):

$2x - 3y$

$= 2(-2) - 3(-3)$

$= -4 + 9$

$= \underline{5}$

$+9 - 4$

$3x - 5y$

x^2y

xy^2

Simplifying algebraic expressions

Remember!

Since **different variables (letters) represent different numbers**, we **cannot** simply add them.

Simplify the following expressions:

a. $x + x + x + x$

$= 4 \times x$

$= 4x$

b. $p \times p \times p$

$= p^3$

c. $2 + 3x + 5 + 2x$

$= 5x + 7$

d. $a + b + a + b$

$= 2a + 2b$

e. $2 \times a + 4 \times b$

$= 2a + 4b$

f. $3x + 5y - 7x + 2y$

$= -4x + 7y$

g. $3 \times a \times b$

$= 3ab$

h. $y + y - x + y - x$

$= 3y - 2x$

i. $4 \times x + (2 + 3) \times x$

$= 4x + 5x$

$= 9x$

j. $t \times t \times t \times t \times t$

$= t^5$

k. $p + 3 + q + 7$

$= p + q + 10$

l. $2x + 4 + y + 3x - 9 - 4y$

$= 5x - 3y - 5$

m. $t + 2w + 5t - (-3w)$

$= t + 2w + 5t + 3w$

$= 6t + 5w$

n. $t + t + t + t + t \times t$

$= t + t + t + t + t^2$

$= 4t + t^2$

o. $2 + (-x) - (+5) - (-3x)$

$= 2 - x - 5 + 3x$

$= 2x - 3$

The distributive law for multiplication!

B R5
C R8

$2(5+8) = 2\times5 + 2\times8$

$2(B+C) = 2B + 2C$

Consider the following examples:

1. $2(x+5)$

$= 2x + 10$

2. $3(x+5+6y)$

$= 3x + 15 + 18y$

3. $a(a-4+b)$

$= a^2 - 4a + ab$

4. $x(x+2)-4x$

$= x^2 + 2x - 4x$

$= x^2 - 2x$

5. $5+x+3-4(x-2)$

$= 8 + x - 4x + 8$

$= -3x + 16$

6. $x(x-4)+x(2-x)$

$x^2 - 4x + 2x - x^2$

$= -2x^2 - 2x$

7. $3(a+y)-5(y-a)$

$= 3a + 3y - 5y + 5a = 8a - 2y$ or $-2y + 8a$

Consider these products

$(a+b)(c+d)$

consider the $(a+b)$ as one thing....

$(a+b)c + (a+b)d$

$c(a+b) + d(a+b)$

$ac + bc + ad + bd$

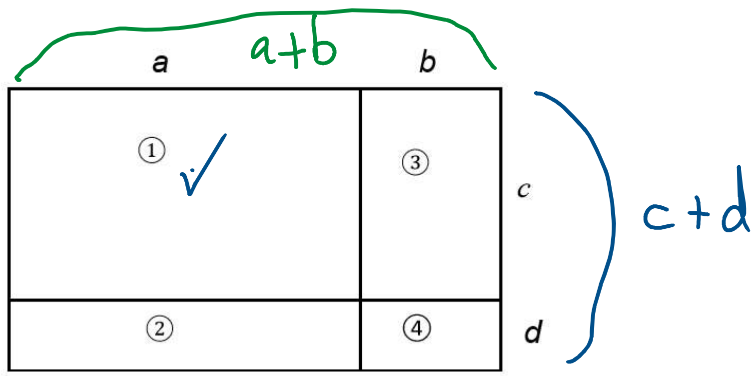
$(a+b)(c+d+e)$

consider the $(a+b)$ as one thing....

$= ac + ad + ae + bc + bd + be$

When we have two polynomials multiplying together then **every term from the one needs to multiply with every term from the other**!

Let's consider the problem of finding the area of the following rectangle with dimensions as shown:



Well, the length is $(a + b)$ and the breadth is $(c + d)$. So, the area is:

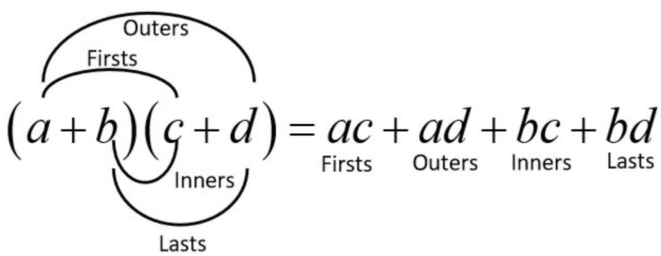
$$(a + b)(c + d)$$
$$= ac + ad + bc + bd$$
① ② ③ ④

Note that each term in the left-hand bracket multiplied with each term in the right-hand bracket.

Note too that each term is the area of one of the four smaller rectangles numbered ①, ②, ③ & ④

Added together they must give the area of the big rectangle.

Because we often multiply binomials by one another there is a mnemonic (a memory aid to help us remember to include all four products). It is called **FOIL**.



Simplify fully:

1. $(x+2)(x+5)$

$= x^2 + 5x + 2x + 10$

$= x^2 + 7x + 10$

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

$= x^2 - 3x + 4x - 12$

$= x^2 + x - 12$

3. $(a+5)(a+2+b)$

$= a^2 + 2a + ab + 5a + 10 + 5b$

4. $(x+1)(x^2-x+1)$

$= x^3 - x^2 + x + x^2 - x + 1$

$= x^3 + 1$

5. $(x+3)^2$

$= (x+3)(x+3)$

$= x^2 + 3x + 3x + 9$

$= x^2 + 6x + 9$

6. $(x+3)^3$

$= (x+3)(x+3)(x+3)$

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

$= x^3 + 6x^2 + 9x + 3x^2 + 18x + 27$

$= x^3 + 9x^2 + 27x + 27$

7. $2(x-3)(x+4)$

$= (2x-6)(x+4)$

$= 2x^2 + 8x - 6x - 24$

$= 2x^2 + 2x - 24$

or

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

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

$= 2x^2 + 2x - 24$

8. $(a+4)(a-5)-(a-1)(a+4)$

$= a^2 - 5a + 4a - 20 - (a^2 + 4a - a - 4)$

$= a^2 - a - 20 - 1(a^2 + 3a - 4)$

$= a^2 - a - 20 - a^2 - 3a + 4$

$= -4a - 16$