Opracowano w ramach projektu “Kadra edukacyjna XXI. wieku”
w I Liceum Ogólnokształcącym im. M. Kopernika w Żywcu

Materiały na lekcje: Język angielski w matematyce

(przygotowane z wykorzystaniem materiałów dostępnych w sieci internetowej)

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Podstawowe słownictwo

(matematyka w języku angielskim)

I

Matematyka - maths lub mathematics.

Działy matematyki (branches of mathematics)

algebra – algebra

arithmetic – arytmetyka

calculus – analiza matematyczna

combinatorial analysis – kombinatoryka

geometry – geometria

mathematical logic – logika matematyczna

solid geometry – geometria przestrzenna

trigonometry – trygonometria

Działania (calculations)

addition – dodawanie

subtraction – odejmowanie

multiplication – mnożenie

division – dzielenie

raising to a power – podnoszenie do potęgi

root – pierwiastek

calculation – obliczenie

equation – równanie

result – wynik

total – suma

difference – różnica

product – iloczyn

quotient – iloraz

unknown – niewiadoma

function – funkcja

variable – zmienna

constant – stała

fraction – ułamek

numerator – licznik

denominator – mianownik

(przygotowane z wykorzystaniem materiałów dostępnych w sieci internetowej)

common denominator – wspólny mianownik

reduce – skrócić

bracket – nawias

square bracket – nawias kwadratowy

equal sign – znak równości

fraction bar – kreska ułamkowa

średnia – mean

median – mediana

coordinate system – układ współrzędnych

the X-axis – oś x

the Y-axis – oś y

II.

Figury geometryczne (geometric figures/shapes)

circle – koło

circumference – okrąg (obwód)

square – kwadrat

triangle – trójkąt

rectangle – prostokąt

rhomb – romb

trapezium – trapez

rhomboid – równoległobok

pentagon – pięciokąt

hexagon – sześciokąt

polygon – wielokąt

sphere – kula

pyramid – ostrosłup

cone – stożek

cube – sześcian

cylinder – walec

prism – graniastosłup

III.

Wymiary (dimensions)

height – wysokość

length – długość

width – szerokość

area – powierzchnia/pole powierzchni

radius – promień

chord – cięciwa

diameter – średnica

perimeter – obwód

volume – objętość

base – podstawa

angle – kąt

acute angle – kąt ostry

right angle – kąt prosty

obtuse angle – kąt rozwarty

round angle – kąt pełny

angle bisector – dwusieczna kąta

side – bok

vertex – wierzchołek

IV.

Liczby i ułamki (numbers and fractions)

Zapraszamy do zapoznania się z liczbami i sposobem ich tworzenia **w tym artykule**.

integer – liczba całkowita

natural number – liczba naturalna

rational number – liczba wymierna

irrational number – liczba niewymierna

prime number – liczba pierwsza

composite number – liczba złożona

factor – czynnik

positive number – liczba dodatnia

negative number – liczba ujemna

even number – liczba parzysta

odd number – liczba nieparzysta

percent – procent

per mille – promil

decimal point – przecinek

units – jedności

tens – dziesiątki

hundreds – setki

thousands – tysiące

1/2 – a half

1/3 – a third

1/4– a quarter

1/5 – a fifth,

2/3 – two thirds etc.

1 ¼ – one and a quarter

2 ½ – two and a half

3 ¾ – three and three quarters

V.

Przybory matematyczne (math tools)

calculator – kalkulator

ruler – linijka

square – ekierka

protractor – kątomierz

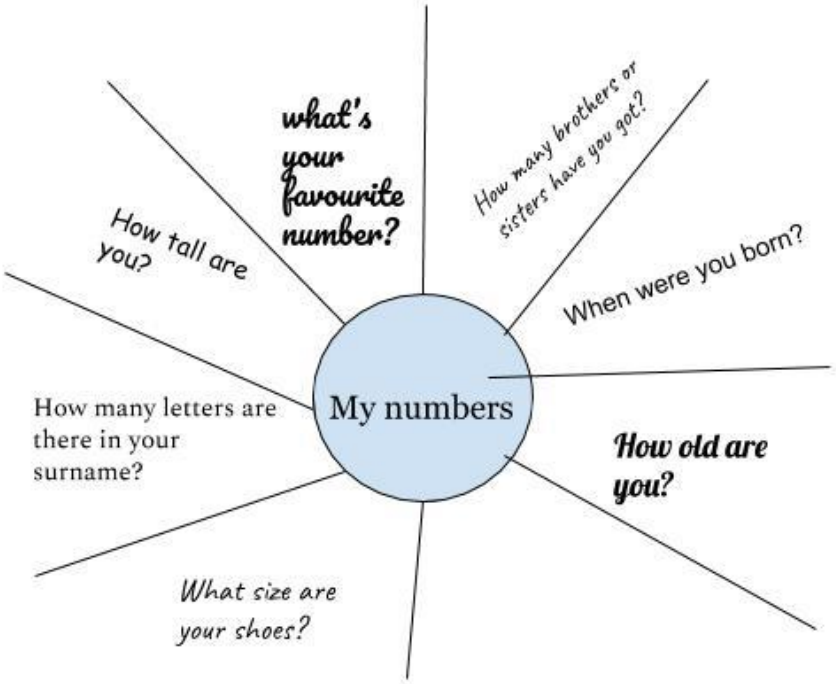
compass – cyrkiel

board – tablica

chalkboard/blackboard – tablica do pisania kredą

chalk – kreda

sponge – gąbka


what's your favourite number?
How many brothers or sisters have you got?
How tall are you?
When were you born?
My numbers
How many letters are there in your surname?
How old are you?
What size are your shoes?

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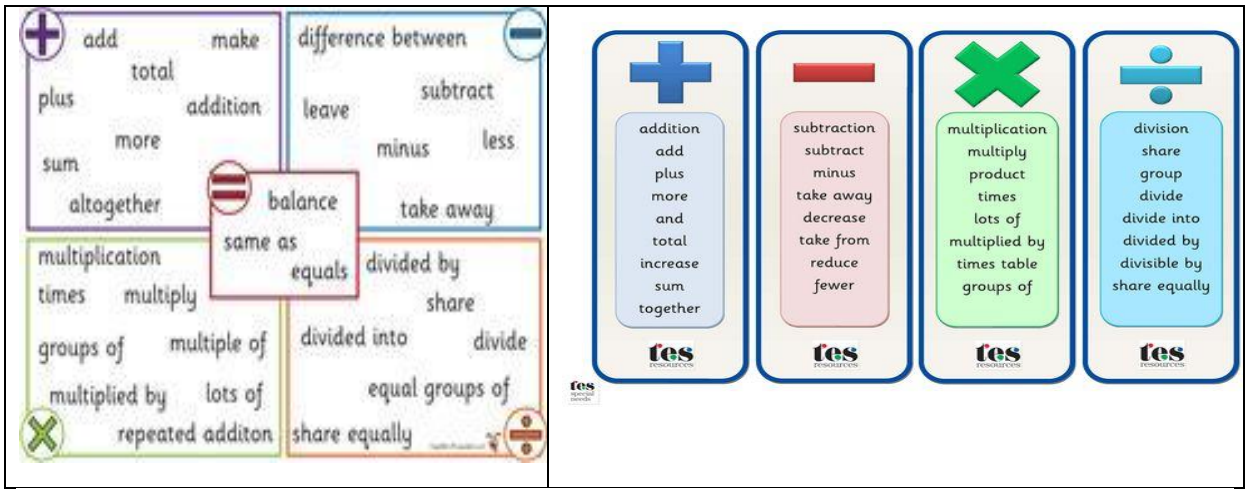
Math operations vocabulary



Math Operations	Symbols	Other Words	
Addition	+	sum Altogether all in all	together total total number add
Subtraction	−	minus greater than more than take away fewer than less than	How many more? How many left? How many less? subtract difference is left
Multiplication	× ●	product multiply multiplied by times	
Division	÷ /	quotient dividend divide divided by	each per average divide equally
Equal	=	the same equals the same as is equal to equivalent	

by Deborah Wahlstrom

(przygotowane z wykorzystaniem materiałów dostępnych w sieci internetowej)

Remember BODMAS. Any calculations inside brackets must be completed before any other part of the sequence.

Without using a calculator work out the answers to the following sequences:

1. 100 – (20 x 3) =
2. (35 – 15) + (27 – 7) =
3. 15 + (6 x 6) =
4. (4 + 5) x (3 + 6) =
5. (5 + 5) x (5 – 2) =
6. 50 – (6 x 6) =
7. (4 + 8) x (3 – 2) =
8. (9 – 3) + (6 x 6) =
9. (5 x 7) – (2 x 5) =
10. 56 – (4 x 7) =
11. 78 – (10 x 7) =
12. (7 x 7) + (4 x 8) =
13. (45 – 23) + (5 x 8) =
14. 38 – (5 x 7) =
15. (100 – 45) + (7 x 7) =
16. 45 – (9 x 4) =

Just a couple of trickier problems.
By putting in brackets in different places, how many different sums and answers can you find for these two sequences:

1. 4 + 4 x 5 – 3 =
2. 8 + 5 x 1 + 3 – 6 =

Film Order of operations: https://www.youtube.com/watch?v=dAgfnK528RA

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Name _____

ORDER of OPERATIONS

Highlight the operation that should be done **FIRST** in each expression. Then evaluate the expression.

$16 \div (1 + 7) =$	$8 + 6 \times 3 =$
$7 + 3 \times 9 \div 3 =$	$10 \div (4 + 1) \times 2 =$
$7 + 12 \div 2 \times 5 =$	$4 + 9 - 6 \div 2 \times 3 =$
$(19 - 4) \times 2 + 7 =$	$17 - (4 \times 2) + 6 =$

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Set Symbols

In the examples C = {1,2,3,4} and D = {3,4,5}

Symbol	Meaning	Example
{ }	Set: a collection of elements	{1,2,3,4}
A ∪ B	Union: in A or B (or both)	C ∪ D = {1,2,3,4,5}
A ∩ B	Intersection: in both A and B	C ∩ D = {3,4}
A ⊆ B	Subset: A has some (or all) elements of B	{3,4,5} ⊆ D
A ⊂ B	Proper Subset: A has some elements of B	{3,5} ⊂ D
A ⊄ B	Not a Subset: A is not a subset of B	{1,6} ⊄ C
A'	Complement: elements not in A	D' = {1,2,6,7} When U = {1,2,3,4,5,6,7}
A − B	Difference: in A but not in B	{1,2,3,4} − {3,4} = {1,2}
a ∈ A	Element of: *a* is in A	3 ∈ {1,2,3,4}
b ∉ A	Not element of: *b* is not in A	6 ∉ {1,2,3,4}
∅	Empty set = {}	{1,2} ∩ {3,4} = Ø
	Universal Set: set of all possible values (in the area of interest)	
P(A)	Power Set: all subsets of A	P({1,2}) = { {}, {1}, {2}, {1,2} }
A = B	Equality: both sets have the same members	{3,4,5} = {5,3,4}
A×B	Cartesian Product (set of ordered pairs from A and B)	{1,2} × {3,4} = {(1,3), (1,4), (2,3), (2,4)}
|A|	Cardinality: the number of elements of set A	|{3,4}| = 2
|	Such that	{ *n* | *n* > 0 } = {1,2,3,...}
:	Such that	{ *n* : *n* > 0 } = {1,2,3,...}
∀	For All	∀ x>1, x^2>x
∃	There Exists	∃ x | x^2>x
	Natural Numbers	{1,2,3,...} or {0,1,2,3,...}
	Integers	{..., -3, -2, -1, 0, 1, 2, 3, ...}
	Rational Numbers	
	Real Numbers	

	Imaginary Numbers	3**i**
	Complex Numbers	2 + 5**i**

https://www.youtube.com/watch?v=m94WTZP14SA

https://www.youtube.com/watch?v=APpe3Wkv8TU

https://www.youtube.com/watch?v=Jt-S9J947C8

Type of number	Example
Real number	
Rational number	
Irrational number	
Integer	
Whole number	
Negative number	
Natural number	
Even number	
Odd number	
Prime number	
Composite number	
Positive number	

Match the names with the definitions

Odd numbers	Any number expressible by the quotient of two integer numbers as in a/b, where b≠0
Integers	Set of these numbers includes all the rational and irrational numbers.
Natural numbers	Set of these numbers includes all the rational and irrational numbers
Whole numbers	Any number that cannot be expressed by an integer or the ratio of two integers.
Rational numbers	The natural numbers plus the zero.
Composite numbers	Any of the positive and negative whole numbers, ..., $^{-}3$, $^{-}2$, $^{-}1$, 0, $^{+}1$, $^{+}2$, $^{+}3$, ...
Real numbers	The set of numbers, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,....., that we see and use every day.
Even numbers	Any number other than 1 which does not have any factor apart from one and the number itself
Irrational numbers	Numbers which are not divisible by 2.
Prime numbers	Numbers divisible by 2
Complex numbers	A number that has more than two distinct factors

Przedziały

https://create.kahoot.it/details/intervals/8af1ffe9-b884-4140-b6f6-8ddf1a345061

https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:functions/x2f8bb11595b61c86:introduction-to-the-domain-and-range-of-a-function/v/introduction-to-interval-notation

Truth Tables and Tautologies

A **truth table** shows how the truth or falsity of a compound statement depends on the truth or falsity of the simple statements from which it's constructed. So we'll start by looking at truth tables for the five logical connectives.

Here's the table for **negation**:

P	$\sim P$
T	F
F	T

This table is easy to understand. If P is *true*, its negation $\sim P$ is *false*. If P is *false*, then $\sim P$ is *true*.

Conjuction $P \wedge Q$ should be *true* when both P and Q are *true*, and *false* otherwise:

P	Q	$P \wedge Q$
T	T	T
T	F	F
F	T	F
F	F	F

Disjunction $P \vee Q$ is *true* if either P is *true* or Q is *true* (or both --- remember that we're using "or" in the inclusive sense). It's only *false* if both P and Q are *false*.

P	Q	$P \vee Q$
T	T	T
T	F	T
F	T	T
F	F	F

Here's the table for logical **implication**:

P	Q	$P \rightarrow Q$
T	T	T
T	F	F
F	T	T
F	F	T

To understand why this table is the way it is, consider the following example:

"If you get an A, then I'll give you a dollar."

The statement will be *true* if I keep my promise and *false* if I don't.

Suppose it's *true* that you get an A and it's *true* that I give you a dollar. Since I kept my promise, the implication is *true*. This corresponds to the first line in the table.

Suppose it's *true* that you get an A but it's *false* that I give you a dollar. Since I *didn't* keep my promise, the implication is *false*. This corresponds to the second line in the table.

What if it's false that you get an A? Whether or not I give you a dollar, I haven't broken my promise. Thus, the implication can't be false, so (since this is a two-valued logic) it must be true. This explains the last two lines of the table.

Equivalence $P \leftrightarrow Q$ ("if and only if") means that P and Q are **equivalent**. So the double implication is *true* if P and Q are both *true* or if P and Q are both *false*; otherwise, the double implication is false.

P	Q	$P \leftrightarrow Q$
T	T	T
T	F	F
F	T	F
F	F	T

A **tautology** is a formula which is "always true" --- that is, it is true for every assignment of truth values to its simple components. You can think of a tautology as a *rule of logic*.

Two statements X and Y are **logically equivalent** if $X \leftrightarrow Y$ is a tautology.

TASK 1
Construct a truth table for the formula $\sim P \wedge (P \rightarrow Q)$.

TASK 2
Show that $(P \rightarrow Q) \vee (Q \rightarrow P)$ is a tautology.

TASK 3

Show that $P \rightarrow Q$ and $\sim P \vee Q$ are logically equivalent.

Ad TASK 1
Construct a truth table for the formula $\sim P \wedge (P \rightarrow Q)$.

P	Q	$\sim P$	$P \rightarrow Q$	$\sim P \wedge (P \rightarrow Q)$
T	T	F	T	F
T	F	F	F	F
F	T	T	T	T
F	F	T	T	T

□

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Algebraic expressions

A

Answer all parts of all questions.

1 **Write the following in symbols.**

a) 4 more than t .....
b) 6 less than a .....
c) 5 times a .....
d) a divided by c .....
e) 5 less than 4 times b .....
f) 6 more than a, divided by n .....
g) 4 less than half of y .....
h) c less than a quarter of p .....

(8 marks)

2 **Simplify the following expressions.**

a) $a \times a \times a$ .....
b) $2 \times a \times 3 \times b$ .....
c) $a \times 3 \times a \times 4$ .....
d) $6 \times b^2 \times c \times b \times 2$ .....

(4 marks)

3 **Here are some cards with expressions.**

Match each expression with the equivalent statement.

$m+2$	five less than m
$m-5$	double m
$\frac{2}{m}$	m squared
$2m$	two divided by m
$5-m$	two more than m
$m \times m$	m less than 5

(6 marks)

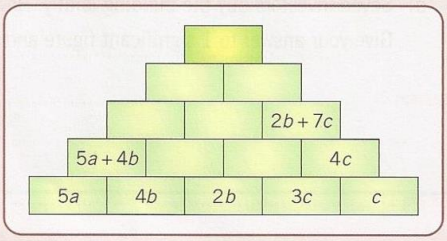
4 **Decide whether these expressions, which have been simplified, are true or false.**

a) $5a + 2a = 7a$ .....
b) $6a + 2b - b = 6a - b$ .....
c) $3a - 5b + 2b = 3a + 3b$ .....
d) $2a + 3a - 5a + 6b - b = 5b$ .....

(4 marks)

5 **For an algebra pyramid, the next layer is formed by adding the two boxes in the row below.**

Complete this algebra pyramid.
Write each expression as simply as possible.



(3 marks)

Score / 25

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Translate Algebraic Expressions

1) Subtract one-fifth from 4 times q _____

2) 5 divided by f _____

3) Take away 4 from 9 times c _____

4) d minus 3 _____

5) d squared plus the product of 2 and s plus 6 _____

6) 5 times the sum of 2 and b _____

7) 4 is subtracted from two-fifths of n _____

8) Three-fifths of the sum of z and 7 plus the product of 4 and w _____

9) Three-fourths of the sum of 4 and y plus the product of 3 and x _____

10) 5 times the sum of c and 3 _____

Translate Algebraic Expressions

1) Subtract one-fifth from 4 times q $4q - \frac{1}{5}$

2) 5 divided by f $5/f$

3) Take away 4 from 9 times c $9c - 4$

4) d minus 3 $d-3$

5) d squared plus the product of 2 and s plus 6 $d^2 + 2s + 6$

6) 5 times the sum of 2 and b $5(2+b)$

7) 4 is subtracted from two-fifths of n $\frac{2}{5}n - 4$

8) Three-fifths of the sum of z and 7 plus the product of 4 and w $\frac{3}{5}(z+7) + 4w$

9) Three-fourths of the sum of 4 and y plus the product of 3 and x $\frac{3}{4}(4+y) + 3x$

10) 5 times the sum of c and 3 $5(c+3)$

(przygotowane z wykorzystaniem materiałów dostępnych w sieci internetowej)

Erasmus+

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Simplifying Algebraic Expressions

1) $9d + 5d$ use $d = 6$

2) $-8 + \frac{c}{9}$ use $c = 18$

3) $5z + 9z + 6$ use $z = -2$

4) $-8(-7r + 6)$ use $r = 4$

5) $-7(-4z + 6) + 3$ use $z = -5$

6) $k - 6k$ use $k = 9$

7) $\frac{-32}{r} - 2 - 6r$ use $r = -8$

8) $6(7 - 4b)$ use $b = -6$

9) $3 - 5k + 9 + 7k$ use $k = 7$

10) $-2 - 4(-7r + 5)$ use $r = -6$

Simplifying Algebraic Expressions

1) $9d + 5d$ use $d = 6$
84

2) $-8 + \frac{c}{9}$ use $c = 18$
-6

3) $5z + 9z + 6$ use $z = -2$
-22

4) $-8(-7r + 6)$ use $r = 4$
176

5) $-7(-4z + 6) + 3$ use $z = -5$
-179

6) $k - 6k$ use $k = 9$
-45

7) $\frac{-32}{r} - 2 - 6r$ use $r = -8$
50

8) $6(7 - 4b)$ use $b = -6$
186

9) $3 - 5k + 9 + 7k$ use $k = 7$
26

10) $-2 - 4(-7r + 5)$ use $r = -6$
-190

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Simplifying Algebraic Expressions

1) -7 - 2(3w - 4z) use z = 4 and w = 7

2) 4(7b + 2k) use k = 6 and b = 9

3) 6r - s use r = 6 and s = -2

4) $-\frac{x}{-5}$ - 2s use x = -15 and s = 3

5) $4r - \frac{f}{6}$ use f = 24 and r = -5

6) 2 - 9c + 5f use c = -4 and f = 4

7) $-\frac{c}{-5}$ - 2 - 8k use c = -20 and k = -2

8) $-2 - \frac{h}{-7}$ + 8d use h = -14 and d = 3

9) -3s - 2 - 9 + 7b use s = -8 and b = -6

10) -5(7n - 3c) use n = 8 and c = -3

Simplifying Algebraic Expressions

1) -7 - 2(3w - 4z) use z = 4 and w = 7
-17

2) 4(7b + 2k) use k = 6 and b = 9
300

3) 6r - s use r = 6 and s = -2
38

4) $-\frac{x}{-5}$ - 2s use x = -15 and s = 3
-9

5) $4r - \frac{f}{6}$ use f = 24 and r = -5
-24

6) 2 - 9c + 5f use c = -4 and f = 4
58

7) $-\frac{c}{-5}$ - 2 - 8k use c = -20 and k = -2
10

8) $-2 - \frac{h}{-7}$ + 8d use h = -14 and d = 3
20

9) -3s - 2 - 9 + 7b use s = -8 and b = -6
-29

10) -5(7n - 3c) use n = 8 and c = -3
-325

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Translating Algebraic Phrases (A)

Name: _____ Date: _____

Write an algebraic expression for each phrase.

1. the product of a number n and six is divided by thirty-one _____
2. the product of a number b and itself _____
3. the square root of the product of a number z and itself _____
4. the sum of a number p and its cube _____
5. the square of the quotient of a number v and five _____
6. the sum of a number q and sixty-four divided by eighty-three _____
7. the difference of the square root of a number r and thirty-seven _____
8. the difference of a number m and itself _____
9. a number y squared plus twice the same number minus seventy-four _____
10. the square root of the difference of a number d and seventy-nine _____
11. the inverse of a number h _____
12. two times the cube of the difference of a number w and forty-two _____
13. the sum of a number f and itself _____
14. four times the square of a number t divided by fourteen more than e _____
15. the quotient of a number g and itself _____
16. fifteen times the sum of a number s and twenty-nine _____
17. the sum of one ninth of a number x and fifty-one _____
18. the sum of a number k and eighty-three to the power of four _____
19. a number j multiplied by itself thirty-four times _____
20. one half of a number c is subtracted from nineteen _____

(przygotowane z wykorzystaniem materiałów dostępnych w sieci internetowej)

Erasmus+

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Translating Algebraic Phrases (A) Answers

Name: _____ Date: _____

Write an algebraic expression for each phrase.

1. the product of a number n and six is divided by thirty-one — $\frac{6n}{31}$
2. the product of a number b and itself — b^2
3. the square root of the product of a number z and itself — z
4. the sum of a number p and its cube — $p + p^3$
5. the square of the quotient of a number v and five — $\left(\frac{v}{5}\right)^2$
6. the sum of a number q and sixty-four divided by eighty-three — $\frac{q+64}{83}$
7. the difference of the square root of a number r and thirty-seven — $\sqrt{r} - 37$
8. the difference of a number m and itself — 0
9. a number y squared plus twice the same number minus seventy-four — $y^2 + 2y - 74$
10. the square root of the difference of a number d and seventy-nine — $\sqrt{d - 79}$
11. the inverse of a number h — $\frac{1}{h}$
12. two times the cube of the difference of a number w and forty-two — $2(w - 42)^3$
13. the sum of a number f and itself — $2f$
14. four times the square of a number t divided by fourteen more than e — $\frac{4t^2}{e+14}$
15. the quotient of a number g and itself — 1
16. fifteen times the sum of a number s and twenty-nine — $15(s + 29)$
17. the sum of one ninth of a number x and fifty-one — $\frac{1}{9}x + 51$
18. the sum of a number k and eighty-three to the power of four — $(k + 83)^4$
19. a number j multiplied by itself thirty-four times — j^{34}
20. one half of a number c is subtracted from nineteen — $19 - \frac{1}{2}c$

(przygotowane z wykorzystaniem materiałów dostępnych w sieci internetowej)

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Percents

Exercises 1:

Match the percents with the correct sentence clue:

25%	I am half of a half. 5 cubic inches of water filled in a 20 cubic inches bottle.
50%	I am less than $\frac{1}{100}$. 25 out of 5,000 contestants won a prize.
30%	The chance of birthing a boy or a girl. A flip of a coin.
1%	I am less than a half but more than one-fourth. 15 out of 50 play drums in a band.
10%	I am equal to 1. 35 questions out of 35 questions were answered correctly.
100%	I am more than 1. Instead of the $1,200 expected to be raised, $3,600 was collected for the school's fundraiser.
300%	I am a tenth of a tenth. One cent out of one dollar.
$\frac{1}{2}\%$	I am less than a fourth but more than a hundredth. $11 out of $110 earned is saved in the bank.

Exercises 2:

Fill in the chart converting between fractions, decimals and percents. Show work in the space provided.

Fraction	Decimal	Percent
$\frac{1}{8}$		
	1,125	
		$\frac{2}{5}\%$

Exercises 3:

Write each number in the alternate from indicated:

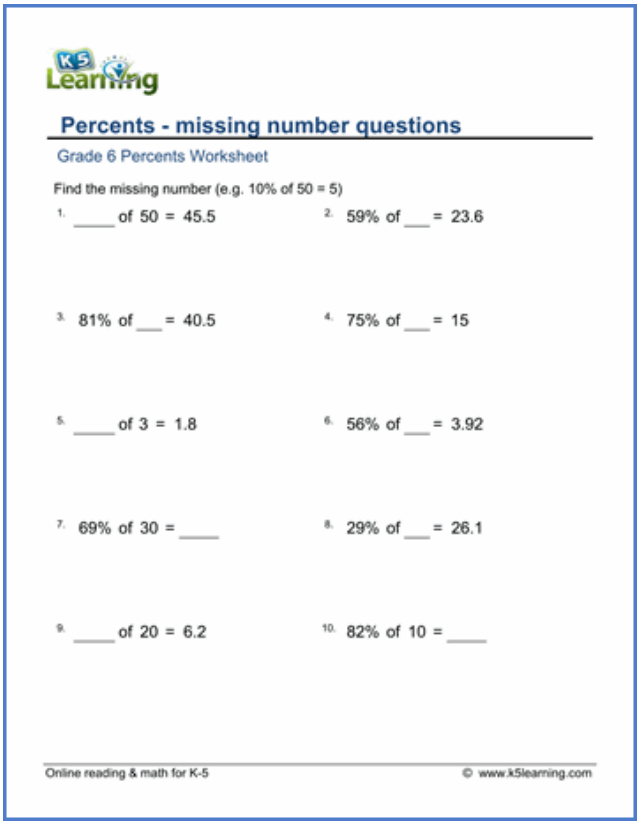
1.	$\frac{20}{100}$ as a percent	
2.	$\frac{40}{100}$ as a percent	
3.	$\frac{80}{100}$ as a percent	
4.	$\frac{85}{100}$ as a percent	
5.	$\frac{95}{100}$ as a percent	
6.	$\frac{100}{100}$ as a percent	
7.	$\frac{10}{10}$ as a percent	
8.	$\frac{1}{1}$ as a percent	
9.	$\frac{1}{10}$ as a percent	
10.	$\frac{2}{10}$ as a percent	
11.	$\frac{4}{10}$ as a percent	
12.	75% as a decimal	
13.	25% as a decimal	
14.	15% as a decimal	
15.	10% as a decimal	

23.	$\frac{9}{10}$ as a percent	
24.	$\frac{9}{20}$ as a percent	
25.	$\frac{9}{25}$ as a percent	
26.	$\frac{9}{50}$ as a percent	
27.	$\frac{9}{75}$ as a percent	
28.	$\frac{18}{75}$ as a percent	
29.	$\frac{36}{75}$ as a percent	
30.	96% as a fraction	
31.	92% as a fraction	
32.	88% as a fraction	
33.	44% as a fraction	
34.	22% as a fraction	
35.	3% as a decimal	
36.	30% as a decimal	
37.	33% as a decimal	

16.	5% as a decimal	
17.	30% as a fraction	
18.	60% as a fraction	
19.	90% as a fraction	
20.	50% as a fraction	
21.	25% as a fraction	
22.	20% as a fraction	

38.	33,3% as a decimal	
39.	3,3% as a decimal	
40.	0,3% as a decimal	
41.	$\frac{1}{3}$ as a percent	
42.	$\frac{1}{9}$ as a percent	
43.	$\frac{2}{9}$ as a percent	
44.	$\frac{8}{9}$ as a percent	

https://create.kahoot.it/details/fraction-decimal-and-percent-conversions/d681319a-9baf-45d0-9f01-7d44ef8579d0



K5 Learning

Percents - missing number questions

Grade 6 Percents Worksheet

Find the missing number (e.g. 10% of 50 = 5)

1. ____ of 50 = 45.5
2. 59% of ___ = 23.6
3. 81% of ___ = 40.5
4. 75% of ___ = 15
5. ____ of 3 = 1.8
6. 56% of ___ = 3.92
7. 69% of 30 = ____
8. 29% of ___ = 26.1
9. ____ of 20 = 6.2
10. 82% of 10 = ____

Online reading & math for K-5 © www.k5learning.com

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w I Liceum Ogólnokształcącym im. M. Kopernika w Żywcu

Name : _____ Score : _____

Teacher : _____ Date : _____

Converting Between Percents, Decimals, and Fractions

Convert Decimal to Percent

1.55 =	0.4 =	0.963 =
0.86 =	1.89 =	0.521 =

Convert Percent to Decimal

184 % =	35 % =	29.2 % =
83 % =	34.2 % =	144 % =

Convert Decimal to Fraction

0.91 =	1.87 =	0.723 =
1.35 =	0.44 =	0.61 =

Convert Fraction to Decimal

$\frac{18}{10}$ =	$\frac{3}{20}$ =	$\frac{17}{10}$ =
$\frac{4}{50}$ =	$\frac{5}{8}$ =	$\frac{39}{25}$ =

Convert Fraction to Percent

$\frac{3}{16}$ =	$\frac{3}{20}$ =	$\frac{14}{20}$ =
$\frac{8}{10}$ =	$\frac{33}{20}$ =	$\frac{1}{20}$ =

Convert Percent to Fraction

96.2 % =	7 % =	24.2 % =
61.3 % =	89 % =	106 % =

Name Date

SPOT THE PERCENTAGE 2C

Work out the missing percentages in these problems. Remember to read carefully!
See if you can spot the impossible problem which cannot be answered!

1) A shop sells 200 chocolate, vanilla and strawberry ice creams in a day. 42 of the ice creams sold are vanilla, and ¼ are strawberry. What percentage are chocolate?

2) An animal park has lions, tigers and zebras. $\frac{2}{5}$ of the animals are lions and $\frac{3}{10}$ of the animals are zebras. What percentage are tigers?

3) LA Galaxy have won $\frac{7}{10}$ of their soccer matches. What percentage have they lost?

4) Out of the 250 million cars on the road in the US, about $\frac{3}{50}$ are diesel. What percentage are not diesel?

5) In a fruit survey, 300 children choose their favourite fruit out of apples, bananas and watermelon. 150 chose apples and 90 chose bananas. What percentage chose watermelon?

6) In a traffic survey, some bikes, buses and cars were recorded. $\frac{4}{5}$ of the vehicles were cars and 7% were buses. What percentage were bikes?

7) There is a 22% chance it will rain tomorrow and a ¼ chance of strong winds. What is the chance it will stay dry?

8) Sally either walks, cycles or drives to work. She walks about $\frac{3}{20}$ of the time and drives about 42% of the time. What percentage of the time does she cycle?

Did you manage to find the impossible problem?

Functions – vocabulary

- function - funkcja
- relation - relacja
- mapping - odwzorowanie
- value - warotść
- domain - dziedzina
- co-domain - przeciwdziedzina
- formula - wzór
- range, image - obraz (funkcji)
- to sketch - naszkicować
- graph - wykres
- $f(x)$ - f of x - *in Polish:* f od x
- $sgn(x)$ - sign of x - *in Polish:* signum x
- $\sin x$ - sine of x - *in Polish:* sinus x
- $\cos x$ - cosine of x - *in Polish:* kosinus x
- $\frac{1}{x}$ - one over x
- $x^2 + 1$ - x square plus one
- $\sqrt{x-1}$ - square root of x minus one
- equal - równe
- to list - wypisać
- well-defined - dobrze zdefiniowany
- inverse function - funkcja odwrotna

- $|x|$ - the absolute value of x
- coordinate system - układ współrzędnych
- OY axis - oś OY
- symmetric - symetryczny
- relatively to ... - względem ...
- the origin of the coordinate system - punkt (0,0)
- non-increasing - nie rosnący
- non-decreasing - nie malejący
- increasing - rosnący
- decreasing - malejący
- strictly - ściśle
- monotonic - monotoniczny
- graph transformation - przekształcenie wykresu

Exercise 1. Write in English using words - not mathematical symbols:

a) $f(x) = x^2 + x - 2$,

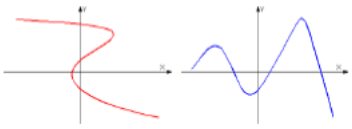
b) $g(x) = \sin(x + \pi)$,

c) $h(x) = \frac{1}{4}x - \frac{2}{5}$.

Properties of functions

DEFINITIONS

A function is a relation that assigns a single element of R to each element of D.



DEFINITION

Two functions $f : D_f \to Y$ and $g : D_g \to Y$ are equal if and only if

$$D_f = D_g$$

and for every x from domain

$$f(x) = g(x)\,.$$

DEFINITION

A function $f : X \to Y$ is

- even if the following equation holds for all $x \in X$:

$$-x \in X \quad \textbf{and} \quad f(-x) = f(x)\,.$$

- odd if the following equation holds for all $x \in X$:

$$-x \in X \quad \textbf{oraz} \quad f(-x) = -f(x)\,.$$

DEFINITION

A function $f : X \to Y$ defined on a subset of the real numbers with real values is called

- increasing (strictly increasing) for all $x_1, x_2 \in X$

$$(x_1 < x_2) \Longrightarrow (f(x_1) < f(x_2)).$$

- decreasing (strictly decreasing) for all $x_1, x_2 \in X$

$$(x_1 < x_2) \Longrightarrow (f(x_1) > f(x_2)).$$

- non-decreasing for all $x_1, x_2 \in X$

$$(x_1 < x_2) \Longrightarrow (f(x_1) \leq f(x_2)).$$

- non-increasing for all $x_1, x_2 \in X$

$$(x_1 < x_2) \Longrightarrow (f(x_1) \geq f(x_2)).$$

EXAMPLE

non-decreasing function

non-increasing function

Properties:

Domain

Range

Zeros (x-intercepts)

Increasing/decreasing intervals

Intervals of positive/negative values

Axis of symmetry

Monotonicity

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Name: _____

ES1

Evaluating Linear Functions

A) Evaluate each function at the specified value.

1) $f(x) = 7x - 5$; $x = 6$

2) $f(x) = 9x + 3$; $x = -10$

_____ _____

B) Evaluate each function.

1) $f(x) = -8x - 9$; find $f(-3)$

2) $f(x) = 4x$; find $f(-15)$

_____ _____

C) If $f(x) = 3(-2x + 7)$; find the following.

1) $f(-7)$ = _____

2) $f(13)$ = _____

3) $f(11)$ = _____

4) $f(-8)$ = _____

D) If $f(x) = -x - 11$; find the following.

1) $4f(-2) + 5f(1)$ = _____

2) $3f(5) \times f(2)$ = _____

3) $-5f(12) - 2f(-9)$ = _____

4) $\frac{f(9)}{f(-6)}$ = _____

E) What is the value of $f(4)$, if $f(x) = -4(x + 3) - 14$?

i) 42 ii) −24 iii) −42 iv) 8

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Name: _____

Evaluate - Function Table

Sheet 1

A) Evaluate each function from the table.

1)

x	−4	2	7	10
$f(x)$	6	11	0	14

i) $f(-4)$ = _____

ii) $f(7)$ = _____

2)

x	5	8	13	19
$f(x)$	37	−13	−55	22

i) $f(13)$ = _____

ii) $f(8)$ = _____

3)

x	−17	−16	−11	3
$f(x)$	−27	−17	1	29

i) $f(3)$ = _____

ii) $f(-17)$ = _____

4)

x	0	4	10	14
$f(x)$	−16	99	0	−8

i) $f(4)$ = _____

ii) $f(14)$ = _____

B) Evaluate the functions from the table.

1)

x	$f(x)$	$g(x)$
6	35	19
13	−19	5
15	8	23

i) $f(13)$ = _____

ii) $f(6)$ = _____

iii) $g(15)$ = _____

iv) $g(13)$ = _____

v) For what value of x, $f(x)$ is 35?

_____

vi) For what value of x, $g(x)$ is 5?

_____

2)

x	$f(x)$	$g(x)$
−6	−24	14
1	4	−4
4	16	10

i) $f(4)$ = _____

ii) $g(1)$ = _____

iii) $g(4)$ = _____

iv) $g(-6)$ = _____

v) For what value of x, $f(x)$ is −24?

_____

vi) For what value of x, $f(x)$ is 4?

_____

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Name: _____

Evaluating Functions

L1ES1

A) Evaluate each function at the specified values.

1) $f(x) = 15 + x$; $x = 7$

2) $f(x) = 2x^5 - 3x^3 - 8x^2 - 9x$; $x = -2$

B) Evaluate each function.

1) $f(x) = x^3 - 5x^2 - x$; find $f(3)$

2) $f(x) = 9x^2 + 5$; find $f(10)$

C) If $f(x) = -7x^4 - 4x^3 - 8x^2 + 12$; find the following.

1) $f(-2)$ = _____

2) $f(-3)$ = _____

3) $f(1)$ = _____

4) $f(0)$ = _____

D) If $f(x) = -4(x + 1)$; find the following.

1) $\frac{8f(-4)}{f(3)}$ = _____

2) $3f(-13) + 5f(6)$ = _____

3) $-4f(1) - 9f(-1)$ = _____

4) $-2f(4) \times f(-5)$ = _____

E) What is the value of $f(-11)$, if $f(x) = 5x^2 - 2x$?

i) 583 ii) −583 iii) −627 iv) 627

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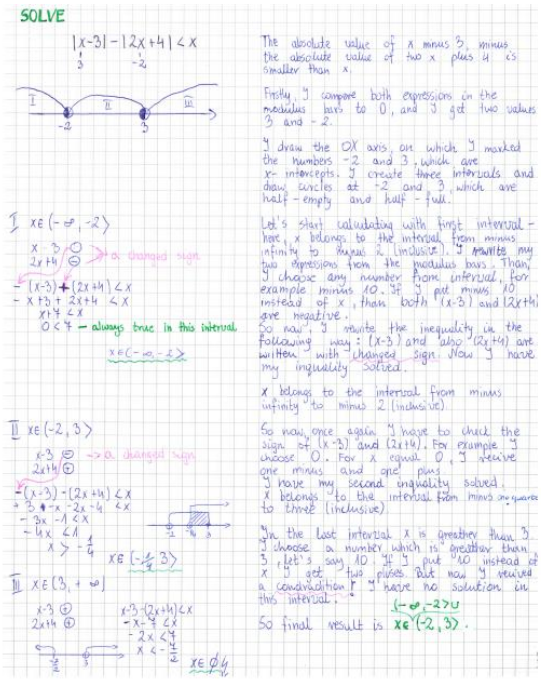
Simplifying and Solving Equations (A)

Name: _____ Date: _____

Determine the value of the unknown in each equation.

1. $2(3-h)-6=-5h$
2. $7+9d=7d+3$
3. $-2(4+3y)=-2(4+y)$
4. $-7+4c=7c+6$
5. $5(1+s)=-9s+6$
6. $3+v=2(2v-1)$
7. $-2-4w=7w-8$
8. $-6(1-m)=9-2m$
9. $-2q-3=-2(2q+1)$
10. $6n+7=2n+5$
11. $2(3x-2)+9=-5x$
12. $3(1+p)=-5(p+1)$
13. $3(1-3g)=-7+g$
14. $1+2b=4b+9$
15. $2z+6=3z+1$
16. $5a-2=-9a+8$
17. $6t-5=-9t-9$
18. $-1+3f=-7-6f$
19. $2+r=7+6r$
20. $-6k+1=-2+7k$

Equations with absolute value



Triangles and angles

https://bit.ly/2ZC1IhG

https://bit.ly/2LZkJCG

Translatios of the graphs (functions)

https://docs.google.com/document/d/1RRtRG0O1Ce2Gv0gyMzCSBMSS_bYA8_tSX3elm9xnuJs/edit?usp=sharing

Inverse proportion

https://bit.ly/3fEj42W

Quadratic function

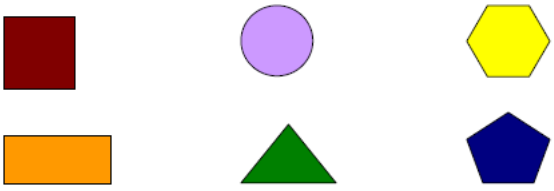
https://bit.ly/2xAJW2x

one stop clil

Pythagoras' Theorem **Worksheet 1**

Activity 1: Match the shapes with their names.

square	triangle	rectangle	circle	pentagon	hexagon



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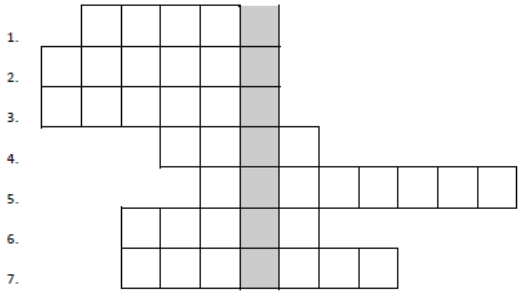
Activity 2: Complete the crossword. What is the vertical word?



1. an angle of 90° is a _____ angle
2. the measurement of how long something is
3. like a rectangle, but the sides are equal
4. the square _____ of 16 is 4 (symbol for this word: √)
5. a shape with three straight sides and three angles (symbol: Δ)
6. a triangle has three angles and three _____
7. the _____ for the perimeter of a triangle is p = a + b +c

Activity 3: Piece the puzzle of Pythagoras together. Use the pieces your teacher will give you.

Activity 4: Read this text about Pythagoras. Then answer the questions.

Pythagoras

Pythagoras lived in the 500s BC, and was one of the first Greek mathematical thinkers. He spent most of his life in the Greek colonies in Sicily and southern Italy. He had a group of followers who followed him around and taught other people what he had taught them. The Pythagoreans were known for their pure lives (they didn't eat beans, for example, because they thought beans were not pure enough). They wore their hair long, and wore only simple clothing, and went barefoot. Both men and women were Pythagoreans.

Pythagoreans were interested in philosophy, but especially in music and mathematics, two ways of making order out of chaos. Music is noise that makes sense, and mathematics is a set of rules for how the world works.

Pythagoras himself is best known for proving that Pythagorean Theorem was true. The Sumerians, two thousand years earlier, already knew that it was generally true, and they used it in their measurements, but Pythagoras is said to have proved that it would always be true. We don't really know whether it was Pythagoras that proved it, because there is no evidence for it until the time of Euclid, but that is the tradition. While we call it Pythagorean Theorem, it was also known by Indian, Greek, Chinese and Babylonian mathematicians well before he lived.

a) What do you know about Pythagoras?

_____

_____

_____

b) Who were Pythagoreans? What were they interested in?

_____

_____

_____

c) What did a Pythagorean look like? (Were they men or women? What did they wear?)

_____

_____

_____

d) What do mathematics and music have in common?

_____

_____

_____

e) Who proved Pythagorean Theorem?

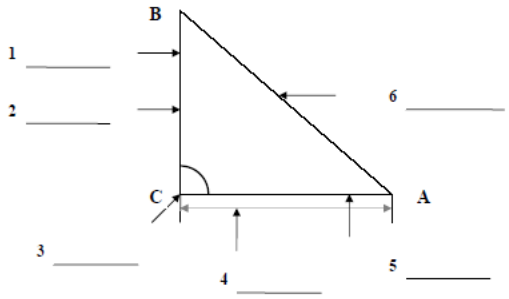
_____

_____

_____

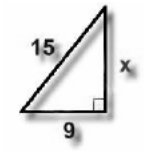
Activity 5: Label this diagram of a right-angled triangle. Use the words in the box.

side	angle	leg (a)	leg (b)	hypotenuse	length

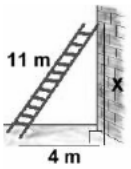


Activity 2: Solve these problems.

a) Find x.

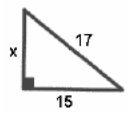


b) How far up a wall will an 11m ladder reach, if the foot of the ladder must be 4m from the base of the wall?



c) You know that a right triangle has a hypotenuse of 13 and a leg of 5. Find the other leg of the triangle without using paper and pencil.

d) Find x.



Activity 3: Read the words. Pay attention to the correct pronunciation.

triangle

square

hypotenuse

angle

right-angled

right-angled triangle

opposite

mathematician

theorem

Pythagoras

Pythagorean Theorem

length

side

root

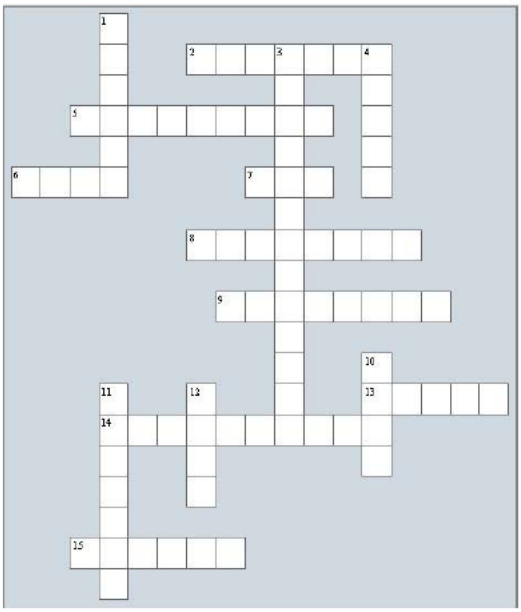
formula

equation

$a2 + b2 = c2$

Activity 4: Complete the crossword.

Pythagorean Theorem



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Across

2. the _____ for calculating the area of a rectangle is Area = Length x Width
5. to find out how much something will cost, how long something will take etc. by using numbers
6. a triangle has three angles and three _____ s
7. one of the sides in a right-angled triangle is called a _____
8. in the _____ 2x + 1 = 7, what is x?
9. the symbol for this word is Δ
13. an angle of 90° is a _____ angle
14. the longest side in a right-angled triangle is called a _____
15. the measurement of how long something is

Down

1. it looks like a rectangle, but the sides are equally long
3. Pythagoras was a Greek _____
4. ∠ β = 60° - what does the symbol ∠ means?
10. the formula for calculating the _____ of a square is A = Length x Length
11. $a^2 + b^2 = c^2$ is the formula for Pythagorean _____
12. the square _____ of 25 is 5 (√25 = 5)

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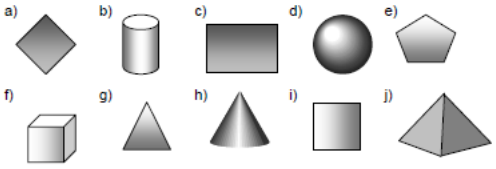
Shapes - worksheets

Activity 1

Part 1

- Are these shapes 2D or 3D?



[design up definitions below to look like dictionary definitions]

A 3D (three-dimensional) shape is not flat. You can measure the height, width and depth of the shape.

A 2D (two-dimensional) shape is flat.

Part 2

- Label the shapes in Part 1 with the names from the box below

[box]
cube cylinder diamond square triangle
cone pyramid rectangle sphere pentagon

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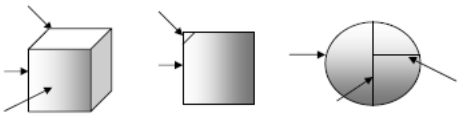
Activity 2

- Read the text about shapes and then label the shapes below with the words in **bold**.

When we learn about shapes there are some important words that we need to know so that we can describe each shape.
Two-dimensional, or 2D shapes have **sides**. So a square has four sides and a pentagon has five. Where two sides meet they make an **angle**. On a square each angle is 90º.

A circle only has one side and the distance all the way round this is called the **circumference**. When we measure a circle the distance from one side to the other through the centre is the **diameter** and the distance from the side to the centre is called the **radius**.

3 dimensional, or 3D shapes are more complex because you can measure the height, width and depth. The surfaces on a 3D shape are called **faces**. The number of faces on a cube is six and on a cylinder only three. Where two faces meet are the **edges**. A cube has twelve edges. Where two edges meet there is a **corner**. A cube has eight corners.



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Activity 3

- Answer these quiz questions.

1. The diameter of a circle is twice the _____?
   a) circumference b) radius
2. How many corners does a (square based) pyramid have?
   a) four b) five
3. How many faces does a cone have?
   a) two b) three
4. A sphere is …
   a) 2D b) 3D
5. How many sides does a triangle have?
   a) three b) four
6. How many angles does a pentagon have?
   a) four b) five
7. Does a sphere have a diameter?
   a) Yes b) No
8. How many edges does a cylinder have?
   a) one b) two

Key

Part 1
2D = a), c), e), g) and i)
3D = b), d), f), h) and j)

Part 2
a) Diamond b) Cylinder c) Rectangle d) Sphere e) Pentagon
f) Cube g) Triangle h) Cone i) Square j) Pyramid

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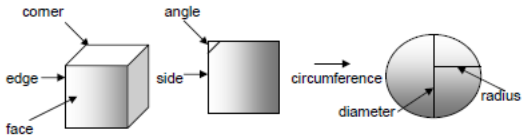
Activity 2

1. Ask students to read the text and tell them not to worry about any new words.
2. Tell them to look at the diagrams below and to label them using the words in the text that are bold.
3. Encourage them to read the text again and look at the words in context.
4. Put students in pairs and ask them to compare and discuss their answers.
5. Check as a class (and go back through the text to clarify the answers).

Key



Activity 3

1. Put students into pairs or small groups. (Move the students around so that they are working with new people).
2. Give them the quiz and set a time limit (about 10 minutes should be plenty of time).
3. Tell them to work together and use the other activities to help them answer the questions.
4. For those groups who finish quickly ask them to write a few questions of their own.
5. Check the quiz answers and then ask the students who have written their own questions to ask the other students.

Key

1 b) radius 2 b) five 3 a) two 4 b) 3D 5 a) three 6 b) five 7 a) Yes 8 b) two

Useful websites

http://www.bbc.co.uk/schools/revisewise/maths/shape/
http://www.bbc.co.uk/schools/ks3bitesize/maths/shape_and_space/index.shtml
http://www.mathleague.com/help/geometry/polygons.htm
http://www.gokidding.com/math.htm

WORKSHEET

Pie charts
by Adrian Tennant

BUSINESS & ESP WORKSHEET

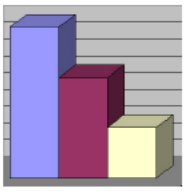
Activity 1

Read the definition of a pie chart.

> **Pie chart** *noun* [c] a circle divided into sections to show how something is divided into different amounts.

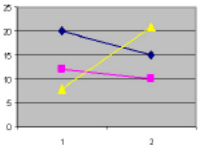
Look at these charts and graphs. Which one is a pie chart: a, b or c?

a)



b)

c)

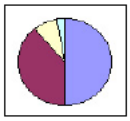


Activity 2

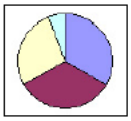
Which pie chart shows this data?

Data
36 people were interviewed about their favourite type of music. Here are the results:
Rock & Pop 19
Classical music 8
Jazz & Blues 5
Folk 4

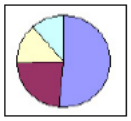
a)



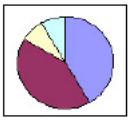
b)



c)



d)



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WORKSHEET

Pie charts
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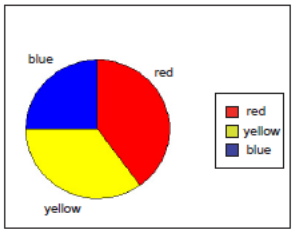
BUSINESS & ESP WORKSHEET

Activity 3

Complete these pie charts with the figures and percentages. In each pie chart, one figure and one percentage is missing: calculate the correct answers and add them to the chart.

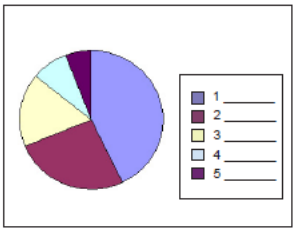
Pie chart 1: 20 people asked about their favourite colour.

8 people (40%) – red, __ people (35%) – yellow, 5 people (__%) – blue



Pie chart 2: 35 people asked about their favourite fruit.

15 people (42%) – banana, __ people (26%) – orange, 6 people (__%) – apple, 3 people (9%) – pear, 2 people (6%) – kiwi



(przygotowane z wykorzystaniem materiałów dostępnych w sieci internetowej)

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WORKSHEET

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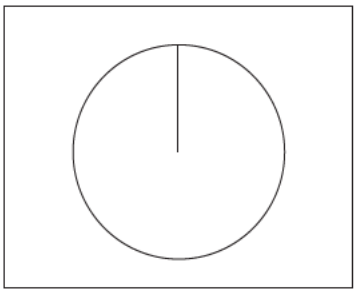
Activity 4

Read this information box about pie charts.

> Pie charts usually start with the biggest piece first. Think of the circle as a clock with 12 o'clock at the top. Start from there with the other pieces in order of size.

Now using this data, draw a pie chart.

40 people were asked about their favourite season of the year.
20 (50%) said summer
10 (25%) said spring
6 (15%) said winter
4 (10%) said autumn



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TEACHER'S NOTES

Pie charts

by Adrian Tennant

BUSINESS & ESP TEACHER'S NOTES

Level: Elementary / pre-intermediate

Topic: Pie charts

Subject: Maths

Target age: Teenagers / adults

Time (approx): Activity 1: 5 minutes.
Activity 2: 5-10 minutes
Activity 3: 10 minutes
Activity 4: 10-15 minutes

Preparation: One photocopy for each student for all activities.
Note: You might want to put the answer keys onto an OHT to show to students.

Procedure

Activity 1

1. Read out the definition of pie charts with your students.
2. Put students in pairs and ask them to look at the three graphs and decide which one is a pie chart.
3. Check as a class.

Key: b is the right answer. (a is a column or bar chart and c is a line chart.)

Activity 2

1. Ask students to look at the data.
2. Check they understand what the information means and ask them to think about what the pie chart might look like.
3. Put students in pairs and ask them to look at the four pie charts.
4. Get them to choose the chart they think represents/shows the data and encourage them to try and explain why.
5. Ask a few students what they think the correct answer is.

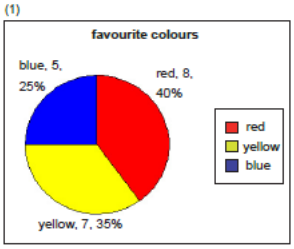
Key: c

Activity 3

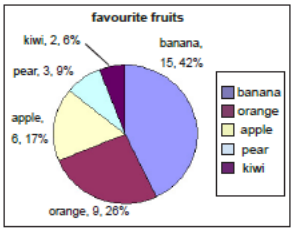
1. Put students in pairs and have them look at the two pie charts and the data.
2. Explain that you want them to label the segments of each pie chart with the correct information.
3. If necessary, do the first segment of the top pie chart together, i.e. red – 8 people, 40%
4. Get students to complete the task with their partner.
5. Monitor and help where necessary.
6. Pair the pairs so students are working in groups of 4 and get them to check their answers together.
7. Check as a class.

Key:

(1)



(2)



(przygotowane z wykorzystaniem materiałów dostępnych w sieci internetowej)

Erasmus+

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TEACHER'S NOTES

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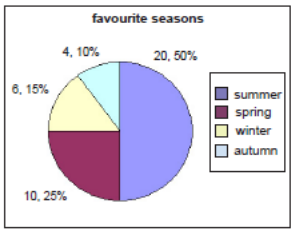
Activity 4

1. Have students read the information box and then check they understand it.
2. Put students in pairs and ask them to read the data.
3. Ask them to work together and draw the pie chart to show / illustrate the data.
4. Monitor and help where necessary.
5. Pair the pairs so students are working in groups of 4 and get them to check their answers together.
6. Check as a class.

Key:



Useful websites

Four web pages that look at pie charts. Starting with the easiest and most basic up to the most complicated of the four.

www.bbc.co.uk/schools/gcsebitesize/geography/geogskills/geogskillsgraphsrev3.shtml

www.subtangent.com/maths/piecharts.php

www.bbc.co.uk/education/asguru/generalstudies/maths/14statisticsprobability/statsprob04.shtml

www.bbc.co.uk/schools/gcsebitesize/maths/datahandlingih/piechartsirev1.shtml

- The number e

The mathematical constant e (the unique real number) is occasionally called Euler's number after the Swiss mathematician Leonhard Euler, or Napier's (Neper's) constant in honor of the Scottish mathematician John Napier who introduced logarithms.

$e \approx 2.71828182845904523536028747135266249775724709369995957496696762772407663035354759457138217852516642742746639193200305992181741...$

- The factorial $n!$ is the product of all positive integers less than or equal to n:

$$n! = 1 \cdot 2 \cdot 3 \cdot 4 \cdot \ldots \cdot (n-1) \cdot n\,, \quad 0! = 1\,,$$

where $n \in N$.
Example: $(n+1)! = \underbrace{1 \cdot 2 \cdot 3 \cdot 4 \cdot \ldots \cdot (n-1) \cdot n}_{n!} \cdot (n+1) = n! \cdot (n+1)$.

- The binomial coefficient: $\binom{n}{k}$

$$\binom{n}{k} = \frac{n!}{k!(n-k)!}$$

where $n \in N$, $k \in N$ and $k \leq n$. We have:

$$\binom{n}{0} = 1 \quad \binom{n}{n} = 1 \quad \binom{n}{1} = n$$

- Algebraic Rules for Working with Powers:

x^n - x to the nth power

$$a^0 = 1\,, \quad a^1 = a\,, \quad a^{n+1} = a^n \cdot a$$

$$a^{-n} = \frac{1}{a^n}\,, \quad a^{\frac{m}{n}} = \sqrt[n]{a^m}$$

$$a^{n+m} = a^n \cdot a^m\,, \quad \frac{a^m}{a^n} = a^{m-n}\,, \quad (a^m)^n = a^{m \cdot n}$$

where $a \in R \setminus \{0\}$, $m, n \in N$.

- Short Multiplication Formulas:

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

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

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