Exercises

02

51.1 How numerate are you? Try this numbers quiz.

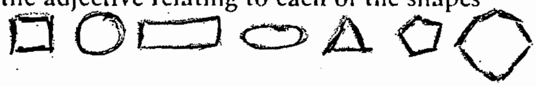
1 Name the first four odd numbers.
2 Name the first four even numbers.
3 Name the first four prime numbers.
4 Give an example of a decimal fraction.
5 Give an example of a vulgar fraction.
6 How do you read this formula and what does it represent: $e=mc^2$?
7 How do you read this and what does it represent: $2\pi r$?

51.2 Write the following in words rather than in figures or symbols.

1 2% of the British population owned 90% of the country's wealth in 1992.
2 0° C = 32° F
3 62.3% of adults have false teeth.
4 $\frac{2}{3} + \frac{1}{4} \times 4^2 = 14\frac{2}{3}$.
5 2,769,425 people live here.

SPHERE, CUBE
PYRAMID, SPIRAL

51.3 Look at the figures in B opposite. What is the adjective relating to each of the shapes illustrated? Use a dictionary if necessary.



51.4 Read the following records aloud.

1 Oxygen accounts for 46.6% of the earth's crust.
2 The nearest star to earth is Proxima Centauri. It is 33,923,310,000,000 km from earth.
3 The highest waterfall in the world is Angel Falls in Venezuela with a drop of 979 m.
4 The top coffee-drinking country in the world is Finland where 1,892 cups per annum are consumed per head of the population.
5 The tallest church in the world is the Chicago Methodist Temple which is 173 m or 568 ft high.
6 The commonest item of lost property on London transport is the umbrella. 23,250 umbrellas were handed in to London transport lost property offices in 1987/8.
7 The country with the most telephones in the world is Monaco. It has 733 telephones per 1,000 population.
8 The smallest country in the world is the Vatican City with an area of 0.4 sq km.

51.5 Draw the following figures.

1 A right-angled triangle with two equal sides of about two centimetres in length. Draw a small circle at the centre of the triangle and then draw lines from the centre of the circle to each of the angles of the triangle.
2 A rectangle with diagonal lines joining opposite angles.
3 An octagon with equal sides. Draw an oval in the middle of the octagon.
4 A three-dimensional rectangular shape of roughly 6 cm by 3 cm by 2 cm.

ADDITION AND SUBTRACTION

Numbers

Our system of *numbers* is composed of the 10 digits 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0. All numbers consist of combinations of these digits. Arithmetic consists of the relations of numbers and the methods of computing with numbers.

In every number each digit has a certain *place value*, and the position of a digit in a number gives the digit its value. From right to left these values are units, tens, hundreds, thousands, ten thousands, and so on. For example, in the four-digit number 9,547, the digit 7 has a value of 7 units, the 4 is in the tens place and has a value of 4 tens (40 units), the 5 is in the hundreds place with a value of 5 hundreds (500 units), and the 9 in the thousands place has a value of 9 thousands (9,000 units).

An *abstract number* is one that has no reference to any quantity or object. For example, the number 16, when used by itself, is an abstract number. In general, you will be concerned with abstract numbers only when dealing with basic mathematical principles and procedures.

Technicians and engineers are more concerned with concrete numbers. A *concrete number* is one that is connected with a particular quantity or object and therefore consists of two parts. The first part is a number which tells us *how much;* the second part specifies the unit of measurement or object and tells us *what.* For example, 60 cycles, 25 ohms, 10 microfarads, and 30 henrys are concrete numbers. In Chap. 11 you will study some interesting methods of dealing with concrete numbers as applied to units and dimensions relating to electricity and electronics.

Addition

In general, concrete numbers should be added only when they are related to the *same kind* of *units* or *things.* For example, it would not make sense to add 47 ohms and 2 horsepower. However, this rule cannot be followed blindly because it *would* be sensible to add 40 resistors and 35 capacitors to obtain 75 parts, or objects. Here, we would be adding parts, or *things.*

The word "plus" indicates addition and is denoted by +. The equality sign = means "is equal to." Thus, in the language of mathematics $6 + 8 = 14$. In English this says that 6 plus 8 is equal to 14. The quantity, or number, obtained by adding two or more numbers is known as the *sum* of those numbers. Therefore, as indicated above, the sum of 6 and 8 is 14.

COMMON FRACTIONS

Definitions

A *common fraction*, as distinguished from a decimal fraction (Chap. 5), is an indicated division of two whole numbers and expresses one or more of the equal parts into which a thing is divided. For example, the common fraction $\frac{5}{6}$ has two meanings, either that 5 is to be divided by 6 or that something has been divided into 5 of 6 equal parts.

The number *above* the line of a fraction, the dividend, is called the *numerator* of the fraction. The number *below* the line, the divisor, is called the *denominator* of the fraction. Note that the numerator states *how many* of the *equal parts* that are contained in the denominator. Thus,

$$\text{A fraction} = \frac{\text{numerator}}{\text{denominator}} = \frac{\text{how many parts}}{\text{number of equal parts}}$$

A fraction in which the numerator is less than the denominator is called a *proper fraction*. $\frac{1}{3}$, $\frac{5}{8}$, and $\frac{12}{13}$ are proper fractions.

An *improper fraction* is one containing a numerator equal to or greater than the denominator. $\frac{4}{4}$, $\frac{9}{9}$, $\frac{3}{2}$, and $\frac{9}{4}$ are improper fractions.

Fundamental properties of fractions

When working with fractions, it is necessary to make frequent use of the following important principles.

1 The numerator and the denominator of a fraction can be multiplied by the same number, except zero, without changing the value of the fraction.

2 The numerator and the denominator of a fraction can be divided by the same number, except zero, without changing the value of the fraction.

EXAMPLE 1 $\frac{4}{5} = \frac{4 \times 3}{5 \times 3} = \frac{12}{15} = \frac{4}{5}$

EXAMPLE 2 $\frac{12}{15} = \frac{12 \div 3}{15 \div 3} = \frac{4}{5} = \frac{12}{15}$

It will be noted that no new principles are involved in performing these operations, because multiplying or dividing both numerator and denominator by the same number, except zero, is the same as multiplying or dividing the fraction by 1.

DIFFERENTIALS

For a system having one independent property which we shall denote by x, let P denote a dependent property,

$$P = P(x) ,$$

and ΔP denote the change of P in a change of state from a state 0. According to Taylor's theorem, we may express ΔP in the form

$$\Delta P = \frac{1}{1\,!}\left(\frac{dP}{dx}\right)\Delta x + \frac{1}{2\,!}\left(\frac{d^2P}{dx^2}\right)\Delta x^2 + \ldots , \qquad (1)$$

where (dP / dx), (d^2P / dx^2), ... are the derivatives of P with respect to x evaluated at state 0, and Δx the change of x in the change of state under consideration.

Equation (1) may be written in the form

$$\Delta P = \left(\frac{dP}{dx}\right)\Delta x + R , \qquad (2)$$

where R is a quantity for which

$$\lim_{\Delta x \to 0}\left(\frac{R}{\Delta x}\right) = 0 . \qquad (3)$$

As in the differential calculus, we shall denote the quantity $(dP / dx)\,\Delta x$ by dP and will call it the differential of P. Thus

$$dP \equiv \left(\frac{dP}{dx}\right)\Delta x . \qquad (4)$$

This expression defines the differential of a dependent property. Differentials may be used in algebraic relations only if the relation applies for all values of Δx. For example the relation

$$dP = 0$$

implies

$$\left(\frac{dP}{dx}\right) = 0 .$$

Similarly, the relationship

$$dN = dM$$

between the differentials of dependent properties N and M implies

$$\left(\frac{dN}{dx}\right) = \left(\frac{dM}{dx}\right) ,$$

whereas the relationship

$$dN = (dM)^2 \qquad (a)$$

implies

$$\left(\frac{dN}{dx}\right) = 0 = \left(\frac{dM}{dx}\right) . \qquad (b)$$

For, (a) can be written as

$$\left(\frac{dN}{dx}\right)\Delta x = \left(\frac{dM}{dx}\right)^2 (\Delta x)^2$$

which is valid for all values of Δx only if (b) is true. It follows that a relationship between differentials of dependent properties is merely a representation of a relationship between derivatives.

The change Δx of the independent variable x during any change of state is also called the differential of x and is denoted by dx . Hence

$$dx \equiv \Delta x \quad . \qquad (5)$$

Accordingly, we may write for the differential dP of P

$$dP = \left(\frac{dP}{dx}\right)\Delta x = \left(\frac{dP}{dx}\right) dx \quad .$$

The above definitions can be generalized to systems of many independent variables. Accordingly, the differential dP of a property of a system having independent properties $x_1, x_2, \dots, x_n$ is defined by the relationship

$$dP \equiv \left(\frac{\partial P}{\partial x_1}\right) dx_1 + \left(\frac{\partial P}{\partial x_2}\right) dx_2 - \dots + \left(\frac{\partial P}{\partial x_n}\right)_{x_i} dx_n$$

where $\qquad (6)$

$$dx_1 \equiv \Delta x_1, \; dx_2 \equiv \Delta x_2, \; \dots, \; dx_n \equiv \Delta x_n \; ,$$

and $(\partial P / \partial x_k)\, x_i$ is the partial derivative of P with respect to x_k , holding all other independent properties x_i $(i \neq k)$ constant.

How to read the main mathematical symbols and signs :

+ plus [ˈplas] - plus

− minus [ˈmainəs] - minus

$\pm$ plus or minus [ˈplas o: ˈmainəs] - plus nebo minus

∞ infinity [inˈfiniti], infinite [ˈinfinit] - nekonečno, nekonečný

a.x, ax: a times x [ˈei ˈtaimz ˈeks] - a krát x; a multiplied by x [ˈei ˈmaltiplaid bai ˈeks] - a násobeno x; ax [ˈei ˈeks] - ax

a:x, a/x: a divided by x [ˈei diˈvaidid bai ˈeks] - a děleno x; a over x [ˈei ˈəuvər ˈeks] - a lomeno x

= equals [ˈi:kwəlz], is equal to [iz ˈi:kwəl tə] - rovná se, je rovno

a:b=x:y a is to b as x is to y [ˈei iz tə ˈbi: əz ˈeks iz tə ˈwai] - a má se ku b jako x má se ku y

$\equiv$ identically equal to [aiˈdentikəli ˈi:kwəl tə] - identicky rovný, totožný

$\neq$ does not equal [ˈdaz not ˈi:kwəl] - nerovná se

$\doteq$ is approximately equal to [ˈiz əˈproksimitli ˈi:kwəl tə] - je přibližně rovno

$>$ greater than [ˈgreitə ðən] - větší než

$<$ less than [ˈles ðən] - menší než

$\ngtr$ not greater than [ˈnot ˈgreitə ðən] - není větší než

$\geqq$ greater than or equal to [ˈgreitə ðən ər ˈi:kwəl tə] - větší než nebo rovno

( ) parentheses [pəˈrenθisi:z], round brackets [ˈraund ˈbrækits] -

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	kulaté závorky
[ ]	brackets , square brackets ['skweə 'brækits] – hranaté závorky
{ }	braces ['breisiz] – složené závorky
(...	brackets opened ['brækits 'əupənd] – závorky, otevřít závorku
...)	brackets closed ['brækits 'kləuzd] – závorky, závorka se zavře
$\tilde{a}$	a tilde ['ei 'tildə] – a s vlnovkou
a^*	a star ['ei 'sta:] – a s hvězdičkou
$\bar{a}$	a bar ['ei 'ba:] – a s pruhem
$\bar{\bar{a}}$	a double bar ['ei 'dabl 'ba:] – a s dvěma pruhy
a'	a dash ['ei 'dæš] – a s čárkou
a_n	a subscript n ['ei 'sabskript 'en] , a sub n ['ei 'sab 'en] – a s indexem n
a_1	a sub one ['ei 'sab 'wan] – a jedna
a_2	a sub two ['ei 'sab 'tu:] – a dvě
$\|a\|$	absolute value of a ['æbsəlu:t 'vælju əv 'ei] – absolutní hodnota z a
$n!$	n factorial ['en fæk'to:riəl] – n faktoriál
$\rightarrow$	tends to ['tendz tə], approaches [ə'prəučiz] – blíží se
$\Rightarrow$	implies [im'plaiz] – implikuje
A	capital a ['kæpitl 'ei] – velké a, A

Greek alphabet ['gri:k 'ælfəbet]

Α α	['ælfə]	alfa
Β β	['bi:tə]	beta
Γ γ	['gæmə]	gama
Δ δ	['deltə]	delta
Ε ε	['epsilən, ep'sailən]	epsilon
Ζ ζ	['zi:tə]	dzeta
Η η	['i:tə]	eta
Θ ϑ	['θi:tə, 'θeitə]	theta
Ι ι	[ai'əutə]	iota
Κ ϰ	['kæpə]	kapa
Λ λ	['læmdə]	lambda
Μ μ	['mju:]	mí
Ν ν	['nju:]	ný
Ξ ξ	['ksai, 'zai]	ksí
Ο ο	['əumikrən, əu'maikrən]	omíkron
Π π	['pai]	pí
Ρ ρ	['rəu]	ró
Σ σ	['sigmə]	sigma
Τ τ	['to:]	tau
Υ υ	['apsilon, 'ipsilon, ju:p'sailən]	ypsilon
Φ φ	['fai]	fí
Χ χ	['kai]	chí
Ψ ψ	['psai]	psí
Ω ω	['əumigə]	omega

Mathematical operations :

Addition [əˈdišən] - sčítání

to add [ˈæd] - sčítat
plus [ˈplas] - plus

$5 + 7 = 12$	five plus seven equals twelve is makes are is equal to
$a + b = c$	a plus b equals c

Subtraction [səbˈtrækšən] - odečítání

to subtract [səbˈtrækt] - odečítat
minus [ˈmainəs] - minus

$9 - 3 = 6$	nine minus three equals six
$a - b = c$	a minus b equals c

Multiplication [ˌmaltipliˈkeišən] - násobení

to multiply [ˈmaltiplai] - násobit
x , . multiplied by, times - násobeno, krát

1 x	once [ˈwans]
2 x	twice [ˈtwais]
3 x	three times (etc.)
$5 \times 3 = 15$	five times three is fifteen
$ab = c$	a (times) b equals c

Division [diˈvižən] - dělení

to divide [diˈvaid] - dělit
: divided by

$6 : 2 = 3$	six divided by two is three
$a : b = c$	a divided by b equals c

Raising to the power [ˈreiziŋ tə ðə ˈpauə] - mocnění

to raise to the power of [tə ˈreiz tə ðə ˈpauər əv] - umocnit na
power [ˈpauə] - mocnina
exponent [eksˈpəunənt] - exponent, mocnina
superscript [ˈsju:pəskript] - vše, co se píše u čísla nahoře, opakem je
subscript [ˈsabskript] - vše, co se píše u čísla dole - index

5^2	five squared [ˈskweəd]
a^3	a cubed [ˈkju:bd]
a^{-3}	a to the minus three
$(a + b)^2$	a plus b all squared
$x^2 + y^2$	x squared plus y squared
$(a + b)^3$	a plus b all cubed

Další mocniny se tvoří : to + člen + řadová číslovka :

a^4	a to the fourth
a^n	a to the nth
a^{n+1}	a to the n plus one
$(a^m)^n$	a to the mth all to the nth

$1 + x^5$	one plus x to the fifth
$(a + b)^{-1}$	a plus b all to the minus one
a^{-1}	a to the minus one
a^{-n}	a to the minus n
$a^{1/3}$	a to the one third
$a^{-1/3}$	a to the minus one third
$a^{1/x}$	a to the one over x
$a^{2/3}$	a to the two thirds

Extraction of the root [iks'trækšən əv ðə 'ru:t] - odmocňování

to extract the /nth/ root /out/ of [iks'trækt] - odmocňovat

index, mn.č. indices ['indeks ; 'indisi:z] - odmocnitel

root ['ru:t] - kořen

$\sqrt{a}$	the square root of a ['skweə]
$\sqrt[3]{a}$	the cube ['kju:b] root of a, a to the one third

Další odmocniny se tvoří : určitý člen + řadová číslovka + root of

$\sqrt[4]{a}$	the fourth root of a
$\sqrt[n]{a}$	the nth root of a, a to the one over n
$\sqrt[x]{a}$	the xth root of a, a to the one over x
$\sqrt[-3]{a}$	the minus cube root of a, častěji: a to the minus one third

Fractions ['frækšənz] - zlomky

a) vulgar fractions ['valgə 'frækšənz] - obecné zlomky

numerator ['nju:məreitə] - čitatel

denominator [di'nomineitə] - jmenovatel

fraction line ['frækšən 'lain] - zlomková čára

1/2	a half, ['ha:f] , one half
1/3	one third
1/4	one quarter, one fourth

Další zlomky se tvoří tak, že v čitateli je vždy základní číslovka, ve jmenovateli řadová. Je-li čitatel větší než 1, je jmenovatel v množném čísle, tj. na konci je -s. Je-li jmenovatel zakončen na jedničku, čteme jej jako základní číslovku. U nepravých zlomků čteme písmena jako v abecedě a "lomeno" jako "over" [əuvə].

3/2	three halves ['ha:vz]
2/5	two fifths ['fifθs]
4/10	four tenths
a/b	a over b
5/21	five over twenty-one

b) decimal fractions ['desiməl 'frækšənz] - desetinné zlomky

Místo desetinné čárky bývá tečka (decimal point ['desiməl 'point])

Nula před desetinnou tečkou se často nepíše a nečte. Místa za desetinnou tečkou se čtou jednotlivě, před desetinnou tečkou jako celek.

0	nought	['no:t]
	o	['əu]
	zero	['ziərəu]
.1 0.1	point one, nought point one	

.01	point nought one
.001	point double nought one
.321	point three two one
2.1	two point one
12.5	twelve point five

Analysis ['kælkjuləs ; ə'næelisiz] - matematická analyza

Functions ['faŋkšənz] - funkce

$f(x)$; $F(x)$, etc.	function of x, function x, fx - funkce x
$y = f(x)$	y is equal to the function of x, y is equal to the function x, y is equal to f of x - y rovná se funkci x

Differentiation [,difərenši'eišən] - derivování

to differentiate [,difə'renšieitə] - derivovat

x to derive [di'raiv] - odvozovat

dy	differential y [difə'renšəl] - diferenciál y
∂y	a variation in y [,veəri'eišən] - variace y
$\triangle y$	an increment of y ['inkrimənt] - přírůstek y
$\frac{dy}{dx}$; $\frac{df(x)}{dx}$; y'; $f'(x)$; $D_x y$	the (first) derivative [di'rivətiv] of y with respect to x, where $y = f(x)$ - první derivace y dle x, kde $y = f(x)$
$f'(x_0)$	the (first) derivative of f at x_0 - první derivace f(x) dle x v bodě x_0
$\frac{d^ny}{dx^n}$; $y^{(n)}$; $f^{(n)}(x)$; $D^n_x y$	the nth derivative of $y = f(x)$ with respect to x - n-tá derivace y podle x d to the nth y by dx to the nth (e.g. $\frac{d^2y}{dx^2}$: d squared y by dx squared ; N.B. is pronounced much longer than in dx above)
$\frac{\partial u}{\partial x}$; u_x ; $f_x(x,y)$; $D_x(u)$ $f'_x(x,y)$	the partial derivative ['pa:šl di'rivətiv] of $u = f(x,y)$ with respect to x - parciální derivace u dle x partial du by partial dx
$f_x(x_0, y_0)$	the first partial derivative of f(x, y) with respect to x at (x_0, y_0) - první parciální derivace f(x, y) podle x v bodě x_0, y_0
$\frac{\partial^2 u}{\partial x\ y}$; u_{xy} ; $f_{xy}(x,y)$; $D_y(D_x u)$	the second partial derivative of $u = f(x, y)$, taken first with respect to x and then with respect to y - druhá parciální derivace $u = f(x,y)$ podle x a y partial d squared u by partial dy dx

Integration [,inti'greišən] - integrování

to integrate ['intigreit]	- integrovat
integrand ['intigrənt]	- integrand
integral ['intigrəl]	- integrál

$\int_a^b$ the integral of .... from a to b - integrál .. od a do b

$\iint$ double integral - dvojný integrál

$\int f(x)\,dx$ the integral of f(x) with respect to x - integrál f/x - dx

$\int_a^b$ the (definite) integral of f(x) from a to be - integrál f(x) dx od a do b

Limits [ˈlimits] - limity

lim limit - limita

$\longrightarrow$ tends [ˈtendz] to, approaches [əˈprəučiz] - blíží se

$\lim_{x \to a} f(x) = b$ the limit of f(x) where x tends to a is equal to b
limita f/x - pro x blížící se a rovná se b

$\lim_{x \to a} [f(x) + g(x)] = s + t$ the limit of f(x) plus g(x) as x tends to a is equal to s plus t

Trigonometry [ˌtrigəˈnomitri] - trigonometrie

sin x	[ˈsain ˈeks] sine x [ˈsain ˈeks]	-	sin x
cos x	[ˈkos ˈeks] cosine x [ˈkəusain ˈeks]	-	cos x
tan x	[ˈtæn ˈeks] tangent x [ˈtændžənt ˈeks]	-	tg x
cot x;ctn x	[ˈkot ˈeks] cotangent x [ˈkəuˈtændžənt ˈeks]	-	ctg x
sec x	secant x [ˈsi:kənt ˈeks]	-	sec x
csc x;cosec x	cosecant x [ˈkəuˈsi:kənt ˈeks]	-	cosec x

E x e r c i s e s

1. **Read :**

a) 2 + 5 = ; 10 + 8 = ; 25 + 15 = ; 78 + 7 = ; 49 + 9 = ; 99 + 1 = ;
129 + 37 = ; 371 + 371 = ; a + b , - x + 1, x + y , 1 + y

b) 19 - 7 = ; 23 - 9 = ; 91 - 18 = ; 11 - 3 = ; 20 - 10 = ; 150 - 100 = ;
1050 - 85 = ; 5,000 - 3,000 = ; a - x , x - 1 , a - b

c) 5.5 = , 3.8 = , 7.7 = , 4.12,= , 13.10 = , 6.9 = , ab = c , xy = z , 2ab

d) 9:3 = , 5:1 = , 21:7 = , 27:9 = , 35:5 = , 100:10 = , 48:12 = , 75:15 = ,
a:b = x, X:Z = y

e) 2/3, 4/7, 1/2, 3/4, 1/10, 5/100, 3/1000, 6/21, 4/3, 5/2
a/b, b^2/c, α/y, $\pi/2$, 1/x, x/2, $1/\sqrt{x}$, c+d/c-d

f) 0.1; .1 ; .002 ; 0.003 ; .2334 ; 5.1 ; 7.99 ; 10.5 ; 100.25 ;

g) 2^2, 2^3, a^2, a^{-2}, a^3, a^{-3}, $(x^2 + y^2) = z$, $a^2 + b^2$, $(a + b)^3$, $(a + b)^m$,
$a^n a^m$, $a^m . a^n = a^{m+n}$, $1/a^n = a^{-n}$, $a^m/a^n = a^{m-n}$, $(a^m)^n = a^{mn}$, $(a/b)^m = a^m/b^m$,
$(a+b)^{-1}$, x^{-1}, x^{-1}, $a^{1/3}$, $a^{-1/3}$, a^x, $a^{1/x}$, $a^{-1/x}$, $(a^{2/3})^x$

h) $\sqrt{x}$, $\sqrt[3]{a}$, $\sqrt[4]{x+1}$, $\sqrt[n]{y}$, $\sqrt[-2]{a}$, $\sqrt[-3]{x}$, $\sqrt[n]{a^n} . a$, $\sqrt[n]{a} = a^{1/n}$,
$\sqrt[m]{a^n} = (\sqrt[m]{a})^n = a^{n/m}$, $\sqrt[n]{1/a} = 1/\sqrt[n]{a} = a^{1/n}$,
$\sqrt[n]{ab} = \sqrt[n]{a} . \sqrt[n]{b}$, $a\sqrt[n]{b} = \sqrt[n]{a^n b}$, $\sqrt[n]{0} = 0$

2. **Read the following signs :**

0 ; $+$; $-$; $\pm$; $a.b$; $a:b$; $x:y = a:b$; $=$; $\equiv$; $\neq$; $\approx$; $\doteq$; $a > b$; $b < a$;
$a \not> b$; $y \not< z$; $(\ )$; $[\ ]$; $\tilde{a}$; a^* ; $\bar{a}$; $\bar{\bar{a}}$; a^{**} ; a' ; a'' ; a_n ; x_1 ; y_2 ;
$|a|$; $n!$; $\rightarrow$; $\rightrightarrows$; X ; a ; $\int$; $\iint$; ∞

3. **Read the following letters of Greek alphabet, giving their Czech names :**

$\alpha, \beta, \gamma, \sigma, \omega, \Delta, \delta, \vartheta, \lambda, \varphi, \mu, \nu, \rho, \eta, \varepsilon, \tau, \chi, \psi,$
$\varkappa, \zeta, \xi, \upsilon, o, \nu; \Sigma, \Pi, \Omega$

4. **Pay attention to stress :**

difference, different, to differentiate, differentiation, differential
add, addition, additional
subtract, subtraction
multiply, multiplication
divide, division
integrate, integral, integration

5. **Translate into Czech :**

a) equation, expression, formula, theorem, theory, quantity, constant, value, property, relation, variable, to define, definition
b) accordingly, hence, thence, whence
c) let us assume that ... ; let a - b ; let P denote .... ; let Equation 1 denote ... ; according to Eq.2, let a = b ;
d) the equation is valid for ... ; (b) is true, if ..... ; Eq.5 holds for ... ; the relation applies for all values of ... ;
e) Eq.1 may be expressed as ... ; we can express Eq.1 as ... ; Eq.3 may be written in the form .... ; P can be written as ... ; the following equation may be put as ....

6. **Translate into English :**

rovnice, sčítání, odčítání, násobení, dělení, výsledek, mocnění, mocnina, index, odmocňování, kořen, zlomek, v čitateli, ve jmenovateli, lomeno, funkce, matematická analýza, derivování, derivovat, odvodit, diferenciál, integrál, integrování, sčítat, odčítat, násobeno 5, děleno 5, umocnit na druhou, umocnit na třetí, mocnit, derivovat, integrovat, odmocňovat

W o r d s

above [əˈbav]	výše uvedený, výše
according to [əˈko:diŋtə]	podle
accordingly [əˈko:diŋli]	podobně, podle toho
algebraic [ˌældžiˈbreiik]	algebraický
to apply [əˈplai] STHING TO STHING	použít, aplikovat,
as [ˈæz, əz]	jako, stejně jako
to be true [ˈbi: ˈtru:]	platit (v mat.)
to be valid [ˈbi: ˈvælid]	platit (– ")
calculus [ˈkælkjuləs]	počet
change [ˈčeindž]	změna
change of state [ˈčeindž əv ˈsteit]	změna stavu

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consideration [kən,sidə'reišən]	úvaha, zřetel
definition [,defi'nišən]	definice
to denote [di'nəut]	označit
dependent [di'pendənt]	závislý
derivative (n.) [di'rivətiv]	derivace
differential [,difə'renšəl]	diferenciál
differential calculus [,difə'renšəl 'kælkjuləs]	diferenciální počet
equation [i'kweižən]	rovnice
to evaluate [i'væljueit]	vypočítat
expression [iks'prešən]	výraz
to follow ['foləu] (FROM)	plynout (z), následovat (za), sledovat
for [fɔ:], [fə]	neboť
to generalize ['dženərəlaiz]	zevšeobecnit
hence ['hens]	odtud plyne, z čehož
to hold, held, held ['həuld; 'held]	ponechávat, držet, platit (o zákonu)
to imply [im'plai]	zahrnovat, implikovat, plynout (z)
in the form [in ðə 'fo:m] OF	ve tvaru
independent (of) [,indi'pendənt]	nezávislý
independent variable [,indi'pendənt 'veəriəbl]	nezávislá proměnná
let [let]	nechť, budiž
merely ['miəli]	pouze
partial ['pa:šəl]	parciální
partial derivative ['pa:šəl di'rivətiv]	parciální derivace
property ['propəti]	vlastnost
quantity ['kwontiti]	množství, veličina
relation [ri'leišən] (between)	vztah (mezi)
relationship [ri'leišənšip]	vztah
representation [,reprizen'teišən]	vyjádření
respect [ris'pekt]	ohled
similarly (to) ['similəli]	podobně, obdobně
state ['steit]	stav
theorem ['θiərəm]	poučka, teorem
thus ['ðas]	tak, z toho, tedy
true ['tru:]	pravdivý, věrný, pravý
under consideration ['andə kən,sidə'reišən]	uvažovaný
valid (for) ['vælid]	platný (pro)
variable (n.) ['veəriəbl]	proměnná
where ['wə:]	kde
whereas [weər'æz]	kdežto
with respect to [wið ris'pekt tə]	dle (mat.)
thence ['ðens]	odtamtud plyne, tudíž
whence ['wens]	odkud plyne, tudíž

Funny mathematics

Try to read the following lines :

1. This poem was written by Jon Saxton, author of many maths texbooks.

A dozen, a gross , and a score
Plus three times the square root of four
All divided by seven,
Plus five times eleven,
Equals nine squared and not a bit more.

Or : for those who have trouble with the poem :

$(12 + 144 + 20 + (3 \times \sqrt{4})) : 7 + (5 \times 11) = 9^2$

2 . This is a limerick (= a humorous poem with 5 lines) attributed to H.L.Carter. It was taken over from „The Lure of the Limerick“ by W.S.Baring-Gould.

´Tis a favourite project of mine
A new value of π to assign.
I would fix it at 3
For it´s simpler, you see,
Than 3 point 1 4 1 5 9

3. And another limerick. It was picked off the net some time ago. It looks better on paper.

Integral z squared dz
From 1 to the cube root of 3
Times the cosine
Of 3 π over 9
Equals log of the cube root of e.

$$\int_1^{\sqrt[3]{3}} z^2 dz . \cos\left(\frac{3\pi}{9}\right) = \ln\left(\sqrt[3]{e}\right)$$

Read the following numbers :

25; 19; 9 ; 2,279; 103; 1,000,000; 14; 40; 104; 138; 500; 44,005; 2,004; 836; 1,017; 6,000; 82,985; 10,000,000; 200,000; 15; 50; 629; 2,102; 12; 17; 70; 708; 7,008; 1,825; 1,901; 348; 990; 3,000; 8,000,000; 1,621; 3,508; 3,528; 3,500; 180; 18; 6,213; 963; 2,000,000,000; 1,526;