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;

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 ; $+$; $-$; $\pm$; $a.b$; $a:b$; $x:y = a:b$; $=$; $\equiv$; $\neq$; $\approx$; $\doteq$; $a > b$; $b < a$;
$a \ngtr b$; $y \nless z$; $(\ )$; $[\ ]$; $\tilde{a}$; a^* ; $\bar{a}$; $\bar{\bar{a}}$; a^{**} ; a' ; a'' ; a_n ; x_1 ; y_2 ;
$|a|$; $n!$; $\rightarrow$; $\Rightarrow$; X ; a ; $\int$; $\iint$; ∞

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

α, β, γ, σ, ω, Δ, δ, ϑ, λ, φ, μ, ν, ρ, η, ε, τ, χ, ψ,
$\varkappa$, ζ, ξ, υ, o, ν; Σ, Π, Ω

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

Case Study: Newton's Law of Cooling

When a hot liquid is placed in a cooler environment, ___________ observation shows that its temperature decreases to _____________ that of its surroundings. A typical graph of the temperature of the liquid _______ against time is shown in Figure 1.

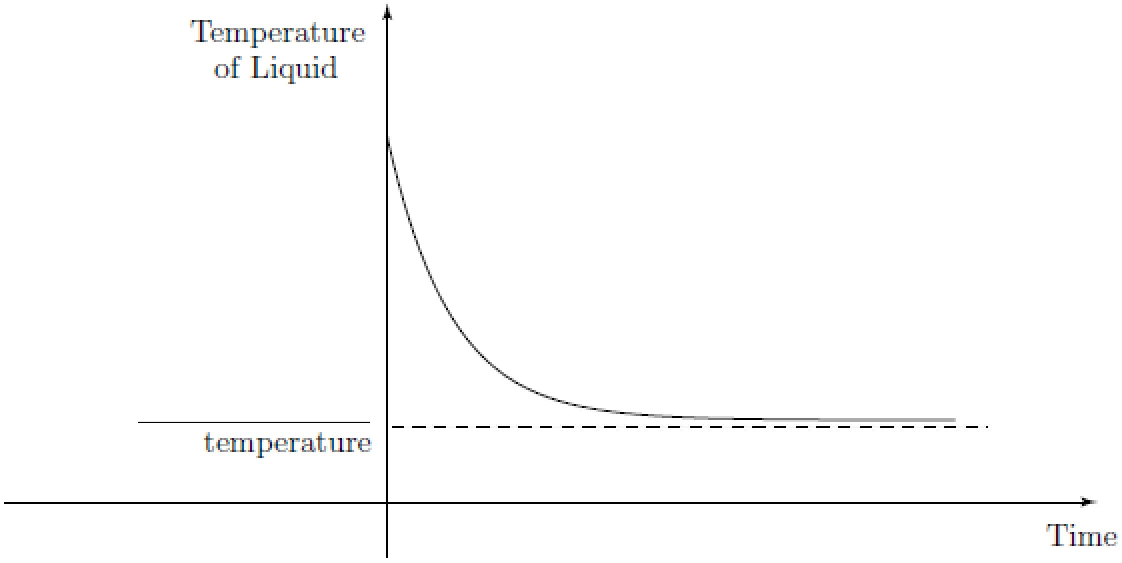

Figure 1:

After an _______ rapid ________ the temperature changes progressively ____ rapidly and ________ _____ the curve appears to 'flatten out'.
Newton's law of cooling states that the rate of cooling of liquid is ____________ to the difference between its temperature and the temperature of its ___________.
To _______ this into mathematics, let t be the time ________ (in seconds, s), θ the temperature of the liquid (^{o}C),and θ_0 the temperature of the liquid at the start ($t = 0$). The temperature of the ____________ is ________ by θ_s.

Try each part of this exercise

Write down the mathematical _________ which is __________ to Newton's law and state the accompanying condition.

Part (a) First, find expressions for the _____ of cooling and the difference between the liquid's temperature and that of the environment.

Part (b) Now formulate Newton's law of cooling.

In the ______ example we call t the ____________ variable and θ the __________ variable. Since the condition is given at $t = 0$ we refer to it as an ______ condition. For reference, the solution of the differential equation which ________ the initial condition is $\theta = \theta_s + (\theta_0 - \theta_s)e^{-kt}$.

Read the text and fill in the missing words:

surroundings	*eventually*	*convert*	*experimental*	*plotted*
satisfies	*independent*	*initial*	*initially*	*above*
denoted	*rate*	*equivalent*	*environment*	
surrounding	*less*	*approximately*	*decrease*	
proportional	*elapsed*	*dependent*	*equation*	

The General Solution of a Differential Equation

Consider the formula $y = Ae^{2x}$ where A is an arbitrary constant. If we differentiate it we obtain

$$\frac{dy}{dx} = 2Ae^{2x}$$

and so, since $y = Ae^{2x}$ we obtain

$$\frac{dy}{dx} = 2y.$$

Then the differential equation satisfied by y is

$$\frac{dy}{dx} = 2y.$$

Notice that we have eliminated the arbitrary constant.
Now consider the formula

$$y = A\cos 3x + B\sin 3x$$

where A and B are arbitrary constants. Differentiating, we obtain

$$\frac{dy}{dx} = -3A\sin 3x + 3B\cos 3x.$$

Differentiating a second time gives

$$\frac{d^2y}{dx^2} = -9\,A\cos 3x - 9\,B\sin 3x.$$

The right-hand side is simply (-9) times the expression for y. Hence y satisfies the differential equation

$$\frac{d^2y}{dx^2} = -9y.$$

Now do this exercise

Find a differential equation satisfied by $y = A\cosh 2x + B\sinh 2x$ where A and B are arbitrary constants.

We have seen that an expression including one arbitrary constant required one differentiation to obtain a differential equation which eliminated the arbitrary constant. Where two constants were present, two differentiations were required. Is the converse true? For example, would a differential equation involving $\frac{dy}{dx}$ as the only derivative have a general solution with one arbitrary constant and would a differential equation which had $\frac{d^2y}{dx^2}$ as the highest derivative produce a general solution with two arbitrary constants? The answer is, usually, yes.

Source: http://www3.ul.ie/~mlc/support/Loughborough%20website/chap19/19_1.pdf