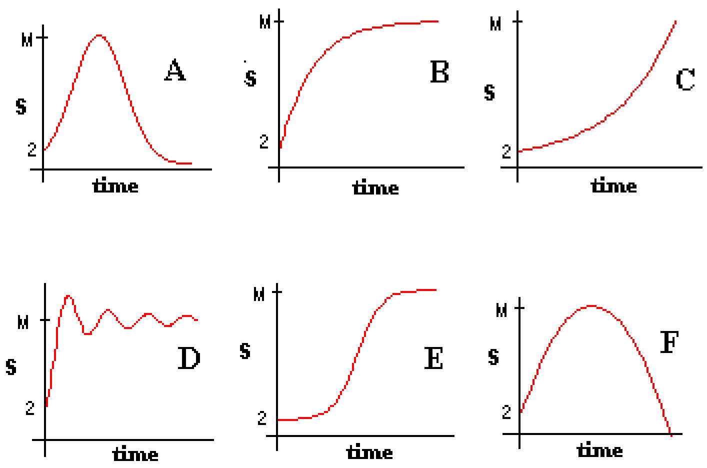
Introduction to Differential Equations www.maths.duke.edu/ode

The spread of a rumor

Suppose two students at your school start a rumor. How could we describe the spread of the rumor throughout the school population? Could we determine a function **S** such that **S(t)** approximates the number of people that know the rumor at a time arbitrary time **t,** where **t** is measured in, say, hours?
We'll begin by trying to decide what the graph of **S** might look like. Assume that **M** is the population of your school and that **M** is sufficiently large that it makes sense to model discrete numbers of students with a continuous function. Thus, if **S(3) = 127.8**, we'll predict that the number of students who know the rumor after **3** hours is approximately **128**.

1. Study the six graphs below. For each graph, decide whether or not it could be the graph of the function **S**. In each case, give the reasons for your decision.

Possible Graphs of S



2. Describe three conditions that **dS/dt**, the rate of spread of the rumor, should satisfy. Keep in mind that we are describing the rate of change of the number of students who know the rumor. Suppose for example, that you know the number of "rumor-aware" students at two o'clock. What factors might determine the number of rumor-aware students at three o'clock? Consider the nature of the rumor itself, conditions at your school, and at least one condition that changes as the rumor spreads.

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Differential equation

From Wikipedia, the free encyclopedia http://en.wikipedia.org/wiki/Differential_equation

Have a look at the text and try to fill in the missing words. First, try to guess, then have a look at the list of words.

A **differential equation** is a mathematical equation for an unknown function of one or several a) .... that relates the values of the function itself and its derivatives of various orders. Differential equations arise in many areas of science and technology: whenever a deterministic relationship involving some continuously varying quantities b) .... by functions and their rates of change in c)........... and/or time (expressed as derivatives) is known or postulated. This is illustrated in classical mechanics, where the d)............ of a body is described by its position and e)............ as the time varies. Newton's Laws allow one to relate the position, velocity, f)............ and various forces acting on the body and state this relation as a differential equation for the unknown position of the body as a function of g).......... In some cases, this differential equation (called an equation of motion) may be h).......... explicitly.

a) variables	derivatives	equations
b) described	modelled	drawn
c) time	force	space
d) state	position	motion
e) acceleration	velocity	position
f) velocity	acceleration	time
g) time	space	gravity
h) counted	solved	guessed

WORD STUDY: Prefixes are important means of creating new words, usually the opposites. There are some words from the text, try to supply prefixes forming new expressions.

dependent	partial ....
proportional	significant ....
known	real ....
natural	continuous ....
changing	finite ....
predictable	mixed ....
important	varied ....

Differential Equations

http://ocw.mit.edu/OcwWeb/Mathematics/18-03Spring-2006/VideoLectures/detail/embed01.htm

$$\frac{d^2y}{dx^2} = \frac{p}{\overrightarrow{K}}\sqrt{1+\left(\frac{dy}{dx}\right)^2}$$

$$y'' = \frac{p}{\overrightarrow{K}}\sqrt{1+(y')^2}$$

a) What is a differential equation?

b) What kinds of differential equations do you know?

Listen to the first part of the lecture and answer the following Qs.

1) What is the lecturer assuming?

   a]…………………………………………………………….

   b]…………………………………………………………….

2) Where can you study differential equations or modeling in case you need some explanations?
3) Which acronyms is the lecturer going to use?
4) What is the difference between two equations the lecturer wrote on the board?
5) What does the blue color indicate?
6) What is the aim of this first lecture?