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APPLICATION OF DERIVATIVES IN DAY TO DAY LIFE

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ABSTRACT

This paper describes how we are using derivatives in our daily activities without even knowing the term Derivative. With the help of derivatives, we understand the theory of changes in behaviour of one object with respect to other object. In most of the cases we study different different object are changing with respect to time. Issac Newton and Gottfried Leibniz independently discovered the calculus in mid-17th century. But does anyone have any idea why did they discover Calculus? Here in this paper you will get the answer of your all questions.

Keywords: *Derivatives, application of derivatives.*

I. INTRODUCTION

We have two variables x and y, in general we consider x as independent variable and y as dependent variable. We establish a relationship between these two variables to generate a Function by using the facts we have. Now we are interested in knowing that how the behaviour of the function is changing with respect to independent variable. "dy/dx" means the rate of change of y with respect to rate of change of x. It gives the instantaneous rate of change. "dy/dx" is positive if y increases with increment of x but negative if y decreases with increment of x.

II. WHY DID WE REALISE THE NEED OF DERIVATIVES?

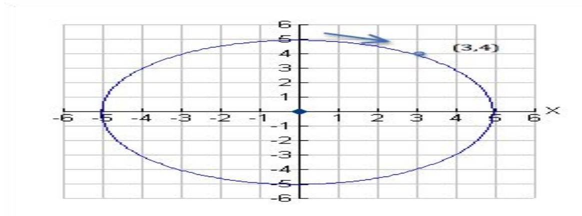
- In ancient time poor navigation was a big problem while traveling through sea and dense forests.
- In those days stars were vital source for navigation.
- Ship goes missing their ways into the sea. Ships never meet the place where the captain supposes it should be. There was not enough understanding how the Earth, Moon, Sun, Stars and the other planet are moving with respect to each other.
- Then differentiation and integration (together known as Calculus) were developed to overcome such situations.
- Differentiation and integration came in to the rescue to solve such type of real world problems.
- We use the derivatives to maximise and minimise the particular functions (e.g. cost, labour, time, profit, loss, space etc.).
- Derivatives are being used in solving many Engineering and Science problems especially when we study the modelling of moving objects.

USES

1. MATHEMATICS

Q- A particle is moving clockwise around a circle of radius 5 cm cantered at the origin. As it passes through the point (3,4), its x position is changing at a rate of 2 cm per second. How fast is y changing at that instant?

Solution: The rates of change (with respect to time t) mentioned in the example are the rates of change of the x-coordinate, dx/dt, and the y-coordinate, dy/dt. Note that we will be trying to find dy/dt at a particular moment in time, which is the moment that the particle is at the point (3,4).



We have found that our variables are x and y, and we need to find a way to relate them. In this problem, the relationship between x and y is given by the fact that they are coordinates on the circle, and that equation will relate them. We know that the equation for the circle is

$$x^2+y^2=25.$$

To find the **related rates**, i.e. to find a relationship between the rates of change of x and y with respect to time, we can implicitly differentiate the equation above with respect to t.

$$2x\ dx/dt+2y\ dy/dt = 0.$$

This is the general relationship between the speed of x and y. When the particle is passing (3,4), then its velocity is dx/dt at (3,4) =2.so we can solve for dy/dt at this precise moment:

$$2(3)(2)+2(4)\ dy/dt \text{ at } (3,4)=0.$$

We have dy/dt at (3,4)= −12/8 = −3/2.

We can now answer the question: y is changing at the rate of −3/2 cm/sec at that instant.

2. BIOLOGY

To find the rate of change of dissolution of drugs into the bloodstream

Eg. A drug is administered to a patient as a constant rate c. As it's administered, though it is converted by the patient's body to other substances at a rate proportional to its current concentration. Formulate a differential equation for how the concentration of the drug, D, changes with time, t.

Solution: $dD/dt = c-kD$, k a constant of proportionality.

3. PHYSICS

Newton's Law of Cooling states that the rate of cooling of an object is proportional to the temperature difference between the room the object is in, and its own temperature. Write down a differential equation which would describe the temperature of the object as a function of time.

Solution: Clearly here our dependent variable will be the temperature of the object *T*, which depends on the independent variable *t*. additionally here though we'll need a constant to describe the temperature of the room that we assume doesn't change with *t*. We'll call this *Tr*. Now we having everything we need to write down our differential equation using the information in the problem:

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dT/dt=k(T−Tr).

4. ECONOMICS

Maximizing Revenue The demand equation for a certain product is p = 6− 1/2 x dollars. Find the level of production that result in maximum revenue.

SOLUTION:- The revenue function R(x) is R(x) = x·p = x (6 – 1/2 x) = 6x – 1/2 x^2 dollars. The marginal revenue is given by R(x) =6 − x.

The graph of R(x) (In Fig.1) is a parabola that opens downward. It has a horizontal tangent precisely at those x for which R (x) = 0 that is, for those x at which marginal revenue is 0. The only such x is x = 6. The corresponding value of revenue is R(6) = 6(6) – 1/2 $(6)^2$ = 18 dollars. Thus, the rate of production resulting in maximum revenue is x = 6, which results in total revenue of 18 dollars.

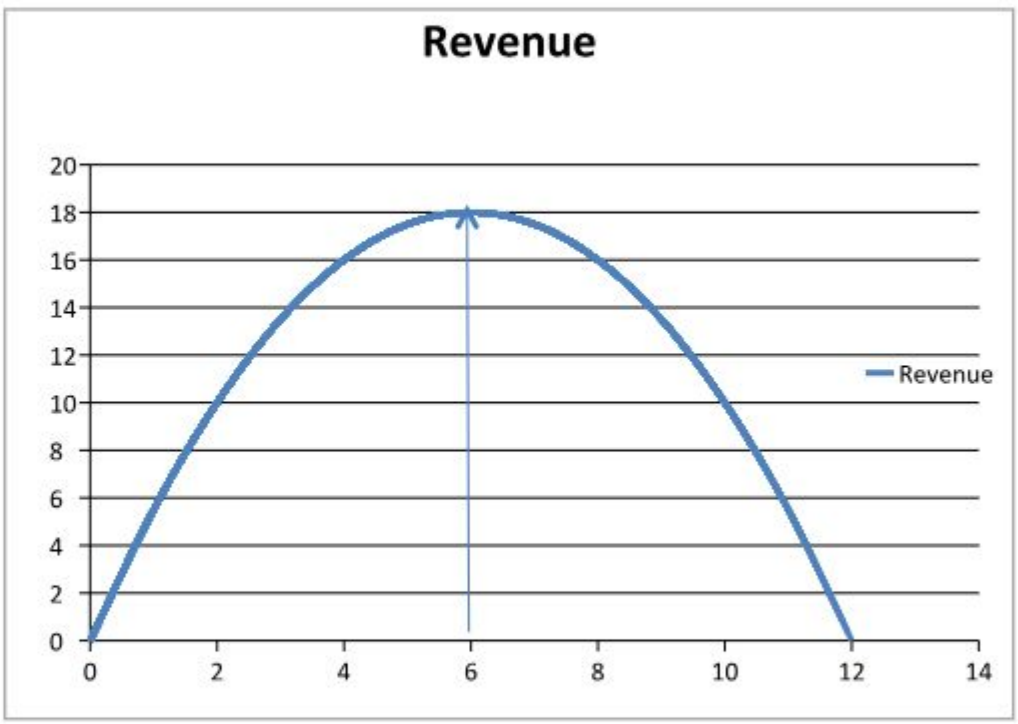

Figure 1

III. CONCLUSION

This paper describes about the modelling of real world problem using Differential Equations. Differential equation plays a prominent role in various disciplines like-Physics, Biology, Economics, and Engineering. Mathematical modelling is being increasingly recognized within every field of science as an important tool that can aid the understanding of systems.

REFERENCES

1. *International Journal of Research (IJR) Vol-1, Issue-11 December 2014 ISSN 2348-6848*
2. *http://math.hawaii.edu/~mchyba/documents/syllabus/Math499/extracredit.pdf*
3. *https://www.ma.utexas.edu/users/m408n/CurrentWeb/LM3-9-3.php*

https://nrich.maths.org/11052