**EG02041 Advanced Mathematics**

**Class 1: Differentiation and Application of Differentiation**

**❑ Review on Differentiation Techniques**

**2.5 Introduction**

**❑ The Power Rule**

1. **Exercise: Evaluate**

❑ **The Derivative of a Sum or a Difference**

1. **Exercise:** Evaluate

**❑ Application of Differentiation**

**2.6 Instantaneous Rates of Change**

1. **Exercise:** *Velocity.* A Cheetah can attain a speed of over 50 mph ≈73 *ft/sec* in 3 sec. Suppose a cheetah runs in such a way that distance *s* (in feet) from the starting point is a function of time *t* (in seconds) as follows:

for

1. Find the average velocity between times *t=*1 and *t=*3.
2. Find the (instantaneous) velocity when *t*=3.

**2.7 The product and Quotient Rules**

**❑ The Product Rule**

1. **Exercise:** Find

**❑ The Quotient Rule**

1. **Exercise:** Differentiate:

**2.8. Chain Rule**

**❑ Extended Power Rule**

1. **Exercise:** Differentiate:

❑**Chain Rule**

1. **Exercise:** Compute the derivatives.
2. **Exercise:** Compute

**2.9 Higher-Order Derivatives**

**9. Exercise:** For find y′ and y″.

**2.9 Higher-Order Derivatives**

**10. Exercise:** *Simple Harmonic Motion.* The vertical position of a weight suspended by a spring is given by

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where *t* is time measured in seconds and *y(t)* is measured in centimetres.

1. Find the velocity function.
2. Find the acceleration function.
3. How are the position and acceleration functions related?

**3.5 Maximum-Minimum Problems**

**11. Exercise:** *Minimizing Surface Area.*A container form is designing an open-top rectangular box, with a square base, that will hold 108 cubic centimetres (cc). What dimensions yield the minimum surface area? What us the minimum surface area?

**Chapter 3: Application of Differentiation**

1. **Exercise:** *Flights of Homing Pigeons*. It is known that homing pigeons tend to avoid flying over water in the daytime, perhaps because the downdrafts of air over water make flying difficult. Suppose a homing pigeon is released on an island at point C, which is **4m** directly out in the water from point B on the shore. Point B is **12m** down shore from the pigeon’s home loft at point A. Assume that a pigeon requires twice the amount of energy per mile to fly over water than to flying over land. At what angle *θ* should the pigeon fly toward the shore in order to minimize the total energy required to get to its home loft?



B

θ

S

A

C

4m

Island

Home Loft

AB=12m

y

*x*

*z*