***Lecture Four* - Integration**

***Section* 4.1 – Antiderivatives**

***Antiderivatives***



**Definition of Antiderivatives**

A Function *F* is an ***antiderivative*** of a function *f* on an interval *I* if

 for all *x* in *I*.

***Theorem***

If *F* is an antiderivative of *f* on an interval *I*, then the most general antiderivative of *f* on *I* is



Where *C* is an arbitrary constant.

**Notation for Antiderivatives and indefinite integrals**

The notation 

where *C* is an arbitrary constant, means that *F* is an Antiderivative of *f*.

That is  for all *x* in the domain of *f*.

 Indefinite integral

Antiderivative

Integrand

Integral sign



Differential

***Basic Integration Rules***











***Example***

Find each indefinite integral.

1. 







1. 







***Example***

Evaluate 

***Solution***







***Example***

Evaluate 

***Solution***



***Example***

Evaluate 

***Solution***



***Example***

Evaluate 

***Solution***



***Definition***

The ***natural logarithm*** is the function given by



Zero width: 

***Definition***

The ***number e*** is that number in the domain of the natural logarithm satisfying



**Other Indefinite Integrals**











***Example***

Evaluate 

***Solution***



***Example***

Evaluate 

***Solution***



***Example***

Evaluate 

***Solution***

 

***Example***

Evaluate 

***Solution***









***Exercises*** ***Section* 4.1 – Antiderivatives**

Find each indefinite integral.

|  |  |  |
| --- | --- | --- |
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Find the function with the following property

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1. Find the general solution of , and find the particular solution that satisfies the initial condition *F*(1) = 8.
2. Derive the position function if a ball is thrown upward with initial velocity of 32 *feet* per second from an initial height of 48 *feet*. When does the ball hit the ground? With what velocity does the ball hit the ground?
3. Suppose a publishing company has found that the marginal cost at a level of production of *x* thousand books is given by



And that the fixed cost (the cost before the first book can be produced) is a $25,000. Find the cost function .