**An Interesting Investigation.**

Consider the graphs:

 ***y = 1 y = 1 y = ex***

 ***x x2***







1. Suppose we want the area between the curve ***y = 1*** and the ***x*** axis from ***1 to b***

 ***x***



b

 ***b***

 ***= ln(x)***

 ***1***

 ***= ln(b) – ln(1)***

 ***= ln(b) – 0***

 ***= ln(b)***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| b | 2 | 10 | 100 | 1000 | 1099 |
| Area | .69 | 2.3 | 4.6 | 6.9 | 228 |

We can see that the area just keeps on getting bigger and bigger.

We say it “increases without bound” which means it approaches infinity.

We could write this as **Area ⭢**

2. Suppose we want the area between the curve ***y = 1*** and the ***x*** axis from ***1 to b***

 ***x2***



 ***b***

***= – 1 = ( – 1 ) – ( –1)***

 ***x b***

 ***1***

 **= *1 – 1***

 ***b***

b

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| b | 2 | 10 | 100 | 1000 | 1000000 |
| Area | 0.5 | 0.9 | 0.99 | 0.999 | 0.999999 |

Clearly the area is increasing but it is approaching a **LIMIT of 1.**

If we examine the expression ***A = 1 – 1***

 ***b***

we can see that as ***b*** gets bigger, ***1*** gets smaller. lim ***1* ⭢ 0**

 ***b b*⭢ *b***

3. Suppose we want the area between the curve ***y = e – x*** and the ***x*** axis from ***0 to b***

 ***b***

***= – e – x  = – e –b – (– e 0)***

 ***0***

***= 1 – 1***

 ***eb***



|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| b | 2 | 5 | 10 | 12 | 15 |
| Area  | 0.86466 | 0.9932 | 0.9999546 | .99999385 | .99999969 |

Clearly the area is increasing but it is also approaching a **LIMIT of 1.**

If we **examine** the expression ***A = 1 – 1***

 ***eb***

we can see that as ***b*** gets bigger, ***1*** gets smaller. lim ***1* ⭢ 0 quickly**

 ***eb b*⭢ *eb***

EXTENTION.

Although the area under y = 1 from 1 to approaches 1

 x2



…the area from zero to 1 does not approach a limit.

Consider the area from ***x = b to x = 1***



 ***1***

***= – 1 = ( – 1) – ( – 1 )***

 ***x b***

 ***b***

 ***= 1 – 1***

 ***b***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| b | 0.5 | 0.1 | 0.01 | 0.0001 | 0.000001 |
| Area  | 1 | 9 | 99 | 9999 | 999999 |

We can see that the area just keeps on getting bigger and bigger.

This area “increases without bound” which means it approaches infinity.

We could write this as **Area ⭢** even though the area to the right of

***x =1*** approaches a limit of 1.