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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| sin(-x) = -sin(x) csc(-x) = -csc(x) cos(-x) = cos(x) sec(-x) = sec(x) tan(-x) = -tan(x) cot(-x) = -cot(x)   |  |  |  | | --- | --- | --- | | sin^2(x) + cos^2(x) = 1 | tan^2(x) + 1 = sec^2(x) | cot^2(x) + 1 = csc^2(x) | | sin(x http://www.math.com/tables/plusminu.gify) = sin x cos y http://www.math.com/tables/plusminu.gifcos x sin y | | |  | | cos(x http://www.math.com/tables/plusminu.gify) = cos x cosy http://www.math.com/tables/minuplus.gifsin x sin y | | |  |   tan(x http://www.math.com/tables/plusminu.gify) = (tan x http://www.math.com/tables/plusminu.giftan y) / (1 http://www.math.com/tables/minuplus.gif tan x tan y)  sin(2x) = 2 sin x cos x  cos(2x) = cos^2(x) - sin^2(x) = 2 cos^2(x) - 1 = 1 - 2 sin^2(x)  tan(2x) = 2 tan(x) / (1 - tan^2(x))  sin^2(x) = 1/2 - 1/2 cos(2x)  cos^2(x) = 1/2 + 1/2 cos(2x)  sin x - sin y = 2 sin( (x - y)/2 ) cos( (x + y)/2 )  cos x - cos y = -2 sin( (x - y)/2 ) sin( (x + y)/2 )   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Trig Table of Common Angles | | | | | | | **angle** | **0** | **30** | **45** | **60** | **90** | | **sin^2(a)** | 0/4 | 1/4 | 2/4 | 3/4 | 4/4 | | **cos^2(a)** | 4/4 | 3/4 | 2/4 | 1/4 | 0/4 | | **tan^2(a)** | 0/4 | 1/3 | 2/2 | 3/1 | **4/0** |   **Given Triangle abc, with angles A,B,C; a is opposite to A, b opposite B, c opposite C:**  a/sin(A) = b/sin(B) = c/sin(C) **(Law of Sines)**   |  |  |  | | --- | --- | --- | | |  | | --- | | c^2 = a^2 + b^2 - 2ab cos(C)  b^2 = a^2 + c^2 - 2ac cos(B)  a^2 = b^2 + c^2 - 2bc cos(A) | | **(Law of Cosines)** |   (a - b)/(a + b) = tan [(A-B)/2] / tan [(A+B)/2] **(Law of Tangents)**  http://www.math.com/tables/barspec.gif |  |  |

Power of x.

|  |  |
| --- | --- |
| (integral)xn *dx* = x(n+1) / (n+1) + C   (n http://www.math.com/tables/not-equ.gif -1)  [Proof](http://www.math.com/tables/integrals/more/x%5En.htm) | (integral)1/x *dx* = ln|x| + C |

Exponential / Logarithmic

|  |  |
| --- | --- |
| (integral)ex *dx* = ex + C    [Proof](http://www.math.com/tables/integrals/more/e%5Ex.htm) | (integral)bx *dx* = bx / ln(b) + C    [Proof](http://www.math.com/tables/integrals/more/b%5Ex.htm), [Tip!](http://www.math.com/tables/integrals/more/b%5Ex.htm#tip) |
| (integral)ln(x) *dx* = x ln(x) - x + C    [Proof](http://www.math.com/tables/integrals/more/ln.htm) |  |

Trigonometric

|  |  |
| --- | --- |
| (integral)sin x *dx* = -cos x + C    [Proof](http://www.math.com/tables/integrals/more/restrig.htm) | (integral)csc x *dx* = - ln|CSC x + cot x| + C    [Proof](http://www.math.com/tables/integrals/more/csc.htm) |
| (integral)COs x *dx* = sin x + C    [Proof](http://www.math.com/tables/integrals/more/restrig.htm) | (integral)sec x *dx* = ln|sec x + tan x| + C    [Proof](http://www.math.com/tables/integrals/more/sec.htm) |
| (integral)tan x *dx* = -ln|COs x| + C    [Proof](http://www.math.com/tables/integrals/more/tan.htm) | (integral)cot x *dx* = ln|sin x| + C    [Proof](http://www.math.com/tables/integrals/more/cot.htm) |

Trigonometric Result

|  |  |
| --- | --- |
| (integral)COs x *dx* = sin x + C     [Proof](http://www.math.com/tables/integrals/more/restrig.htm) | (integral)CSC x cot x *dx* = - CSC x + C     [Proof](http://www.math.com/tables/integrals/more/restrig.htm) |
| (integral)sin x *dx* = COs x + C     [Proof](http://www.math.com/tables/integrals/more/restrig.htm) | (integral)sec x tan x *dx* = sec x + C     [Proof](http://www.math.com/tables/integrals/more/restrig.htm) |
| (integral)sec2x *dx* = tan x + C     [Proof](http://www.math.com/tables/integrals/more/restrig.htm) | (integral)csc2x *dx*= - cot x + C     [Proof](http://www.math.com/tables/integrals/more/restrig.htm) |

Inverse Trigonometric

|  |
| --- |
| (integral)arcsin x *dx*= x arcsin x + sqrt(1-x2) + C |
| (integral)arccsc x *dx* = x arccos x - sqrt(1-x2) + C |
| (integral)arctan x *dx* = x arctan x - (1/2) ln(1+x2) + C |

Inverse Trigonometric Result 

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  | | --- | --- | --- | --- | | |  |  |  | | --- | --- | --- | | (integral) | *dx*  sqrt(1 - x2) | = arcsin x + C | | | |  |  |  | | --- | --- | --- | | (integral) | *dx*  x sqrt(x2 - 1) | = arcsec|x| + C | | | |  |  |  | | --- | --- | --- | | (integral) | *dx*  1 + x2 | = arctan x + C | | | |  | | --- | | **Useful Identities**  arccos x = pi/2 - arcsin x   (-1 <= x <= 1)  arccsc x = pi/2 - arcsec x   (|x| >= 1)  arccot x = pi/2 - arctan x   (for all x) | |

Hyperbolic

|  |  |
| --- | --- |
| (integral)sinh x *dx* = cosh x + C     [Proof](http://www.math.com/tables/integrals/more/sinh.htm) | (integral)csch x *dx* = ln |tanh(x/2)| + C     [Proof](http://www.math.com/tables/integrals/more/csch.htm) |
| (integral)cosh x *dx* = sinh x + C     [Proof](http://www.math.com/tables/integrals/more/cosh.htm) | (integral)sech x *dx* = arctan (sinh x) + C |
| (integral)tanh x *dx* = ln (cosh x) + C     [Proof](http://www.math.com/tables/integrals/more/tanh.htm) | (integral)coth x *dx* = ln |sinh x| + C    [Proof](http://www.math.com/tables/integrals/more/coth.htm) |

Top of Form



Bottom of Form

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**Arithmetic Sequences and Sums**

**Sequence**

A [Sequence](http://www.mathsisfun.com/algebra/sequences-series.html) is a set of things (usually numbers) that are in order.

|  |
| --- |
| Sequence |

**Arithmetic Sequence**

In an Arithmetic Sequence **the difference between one term and the next is a constant**.

In other words, we just add the same value each time ... infinitely.

**Example:**

|  |
| --- |
| 1, 4, 7, 10, 13, 16, 19, 22, 25, ... |

This sequence has a difference of 3 between each number.

**In General** we could write an arithmetic sequence like this:

{a, a+d, a+2d, a+3d, ... }

where:

* **a** is the first term, and
* **d** is the difference between the terms (called the **"common difference"**)

**Example: (continued)**

|  |
| --- |
| 1, 4, 7, 10, 13, 16, 19, 22, 25, ... |

Has:

* a = 1 (the first term)
* d = 3 (the "common difference" between terms)

And we get:

{a, a+d, a+2d, a+3d, ... }

{1, 1+3, 1+2×3, 1+3×3, ... }

{1, 4, 7, 10, ... }

**Rule**

We can write an Arithmetic Sequence as a rule:

xn = a + d(n-1)

(We use "n-1" because **d** is not used in the 1st term).

**Example: Write the Rule, and calculate the 4th term for**

|  |
| --- |
| 3, 8, 13, 18, 23, 28, 33, 38, ... |

This sequence has a difference of 5 between each number.

The values of **a** and **d** are:

* **a = 3** (the first term)
* **d = 5** (the "common difference")

The Rule can be calculated:

**xn** = a + d(n-1)

= 3 + 5(n-1)

= 3 + 5n - 5

= **5n - 2**

So, the 4th term is:

x4 = 5×4 - 2 = 18

Is that right? Check for yourself!

Arithmetic Sequences are sometimes called Arithmetic Progressions (A.P.’s)

**Summing an Arithmetic Series**

**To sum up** the terms of this arithmetic sequence:

a + (a+d) + (a+2d) + (a+3d) + ...

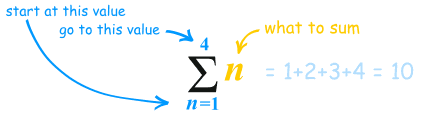
use this formula:

Sigma

What is that funny symbol? It is called [Sigma Notation](http://www.mathsisfun.com/algebra/sigma-notation.html)

|  |  |
| --- | --- |
| Sigma | (called Sigma) means "sum up" |

And below and above it are shown the starting and ending values:



It says "Sum up ***n*** where ***n*** goes from 1 to 4. Answer=**10**

Here is how to use it:

**Example: Add up the first 10 terms of the arithmetic sequence:**

{ 1, 4, 7, 10, 13, ... }

The values of **a**, **d** and **n** are:

* **a = 1** (the first term)
* **d = 3** (the "common difference" between terms)
* **n = 10** (how many terms to add up)

So:

Sigma

Becomes:

Sigma

= 5(2+9·3) = 5(29) = 145

*Check: why don't you add up the terms yourself, and see if it comes to 145*

**Why Does the Formula Work?**

I want to show you **why** the formula works, because we get to use an interesting "trick" which is worth knowing.

**First**, we will call the whole sum **"S"**:

S = a + (a + d) + ... + (a + (n-2)d) + (a + (n-1)d)

**Next**, rewrite S in reverse order:

S = (a + (n-1)d) + (a + (n-2)d) + ... + (a + d) + a

Now add those two, term by term:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| S | = | a | + | (a+d) | + | ... | + | (a + (n-2)d) | + | (a + (n-1)d) |
| S | = | (a + (n-1)d) | + | (a + (n-2)d) | + | ... | + | (a + d) | + | a |
|  |  |  |  |  |  |  |  |  |  |  |
| 2S | = | (2a + (n-1)d) | + | (2a + (n-1)d) | + | ... | + | (2a + (n-1)d) | + | (2a + (n-1)d) |

**Each term is the same!** And there are "n" of them so ...

2S = n × (2a + (n-1)d)

Now, just divide by 2 and we get:

S = (n/2) × (2a + (n-1)d)

Which is our formula:

Sigma

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Sometimes we say, “probably it may rain” or “Probably he may get more than 90% in the examination" etc. These are elements of certainty. Means we are not certain about some things. In mathematics these comes under Probability.

The theory of probability is widely used in the area of natural as well as social science.

Probability as a Measure of Uncertainty

Suppose we through a die which is a well balanced cube with its six faces marked numbers from 1 to 6, one number of one face, we see the number which come up on its uppermost face. A die can fall with any of its face upper most.

The number on each of the face is equally libely and possible outcome. There are six equally likely ealy outcomes: 1, 2, 3, 4, 5 or 6 in a single throw of a die. The chance of any number ‘say 3’ to come up is 1 out of 6. That is probability of 3 coming up is 1/6   
i.e. p(3) = 1/6

Similarly in tossing a coin, we may get either head (H) or tail (T) up and P(H) = ½

Hence probability of an event E is

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There are only six possible outcome in a single throw of a die. If we want to find probability of 7 or 8 to come up, then in that case number of possible or favorable outcome is O (zero), hence P(7) = 0/6 = 0

i.e. probability of an impossible event is zero.

If we consider to find the probability of number less than 7, then all six cases are favorable and hence P(number less than 7) = 6/6 = 1

i.e. probability of sure event is 1

Now, P (3) = 1/6, then probability of numbers of other than 3 must be 5/6

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**Example 1.** An unbiased dice is tossed.

1. Write the sample space of the experiment
2. Find the probability of getting a number greater than 4.
3. Find the probability of getting a prime number.

**Solution:-**

1. Sample space = {1, 2, 3, 4, 5, 6}

n(s) = 6

1. E = event of getting a number greater than 4  
     
   = {5, 6}

n (E) = 2

P (> 4) = Probability of a number greater than 4  
= n(E)/n(S) = 2/6 = 1/3

1. E = Event of getting a prime number   
     
   = {2, 3, 5}

n (E) = 3  
  
P(Prime number) = Probability of a prime number  
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