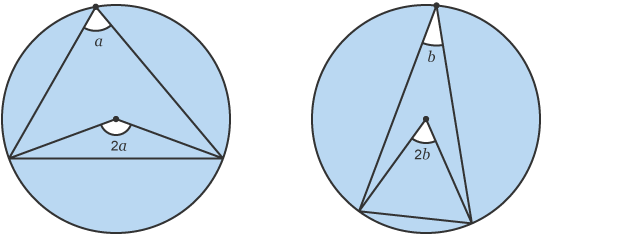
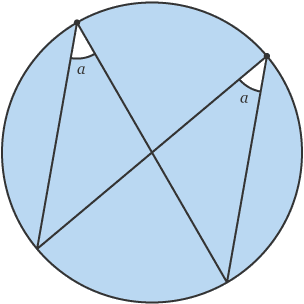
1. **Circle Theorems**
2. ***Angles at the centre and circumference***

The angle at the centre is double the angle at the circumference



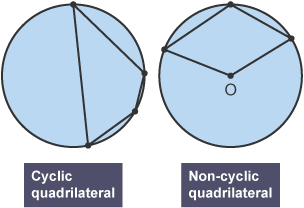
1. ***Angles in the same segment***

Angles in the same segment are equal.



1. ***Cyclic quadrilateral***

A **cyclic quadrilateral** is a quadrilateral drawn inside a circle. Every vertex of the quadrilateral must touch the circumference of the circle.

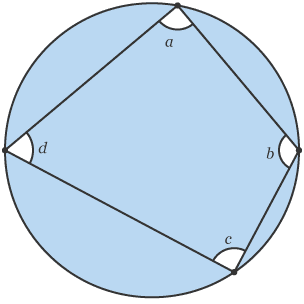


The second shape is not a cyclic quadrilateral. One vertex does not touch the circumference.

The opposite angles in a cyclic quadrilateral add up to 180°.

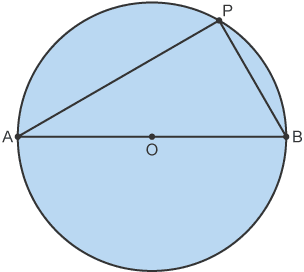
a + c = 180^\circ

b + d = 180^\circ



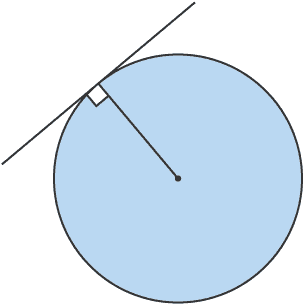
1. ***Angles in a semicircle***

The angle at the circumference in a semicircle is a right angle.

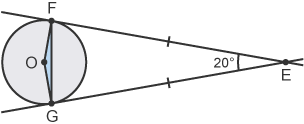


Angle APB = 90°

1. ***The angle between a tangent and a radius is 90°.***

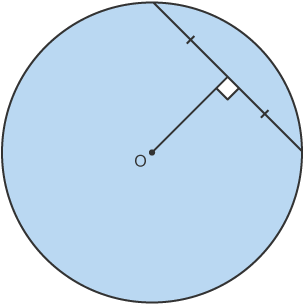


1. ***Tangents which meet at the same point are equal in length.***



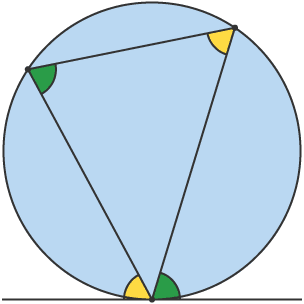
1. ***Chords***

The perpendicular from the centre of a circle to a chord bisects the chord.

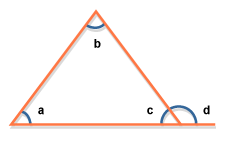


1. ***The alternate segment theorem***

The angle between a tangent and a chord is equal to the angle in the alternate segment.



1. **Angle Theorems**
2. ***The exterior angle is equal to the sum of the two opposite interior angles. This is true for any triangle.***

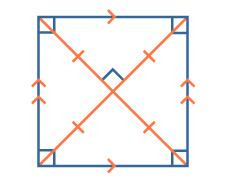


d = a + b

1. ***Quadrilaterals***

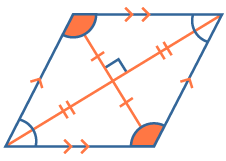
The angles in a quadrilateral add up to 360º. There are other facts that you will need to know about special types of quadrilaterals. These are shown below:

**Square**



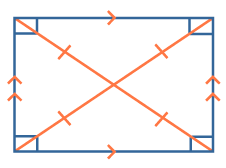
A square is a regular quadrilateral. All of its angles are equal (90°). All of its sides are of equal length. Opposite sides are parallel. The diagonals bisect each other at 90°. The diagonals are equal in length. It has 4 lines of symmetry. Order of rotational symmetry: 4.

**Rhombus**



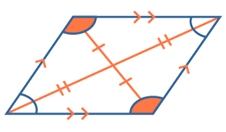
Diagonally opposite angles are equal. All of its sides are of equal length. Opposite sides are parallel. Diagonals bisect each other at 90°. It has 2 lines of symmetry. Order of rotational symmetry: 2.

**Rectangle**



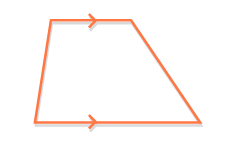
All angles are equal (90°). Opposite sides are of equal length. Opposite sides are parallel. The diagonals bisect each other. The diagonals are equal in length. It has 2 lines of symmetry. Order of rotational symmetry: 2.

**Parallelogram**



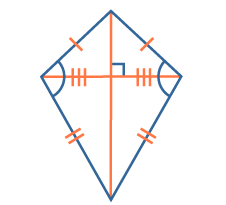
Diagonally opposite angles are equal. Opposite sides are of equal length. Opposite sides are parallel. The diagonals bisect each other. It has no lines of symmetry. Order of rotational symmetry: 2.

**Trapezium**



One pair of opposite sides is parallel. It has no lines of symmetry. It has no rotational symmetry.

**Kite**



Two pairs of sides are of equal length. One pair of diagonally opposite angles is equal. Only one diagonal is bisected by the other. The diagonals cross at 90°. It has 1 line of symmetry. It has no rotational symmetry.

1. ***Angle properties of polygons***

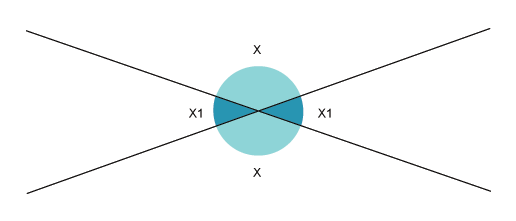
The formula for calculating the sum of the interior angles of a regular polygon is: **(n - 2) × 180°** where **n** is the number of sides of the polygon.

1. ***Interior angle of a regular polygon = sum of interior angles ÷ number of sides***
2. ***Exterior angle***

Exterior angle of a regular hexagon is 360 over 6 = 60 degrees

1. ***Vertically opposite angle***

When two lines intersect, the opposite (X) angles are equal:



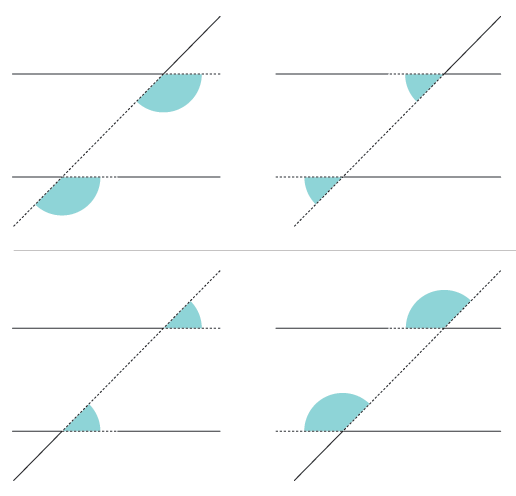
1. ***Alternate (Z) angle***

On parallel lines, alternate (Z) angles are equal:



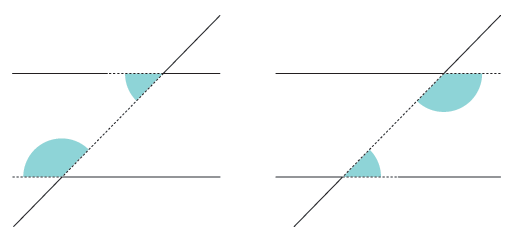
1. ***Corresponding (F) angle***

On parallel lines, corresponding (F) angles are equal:

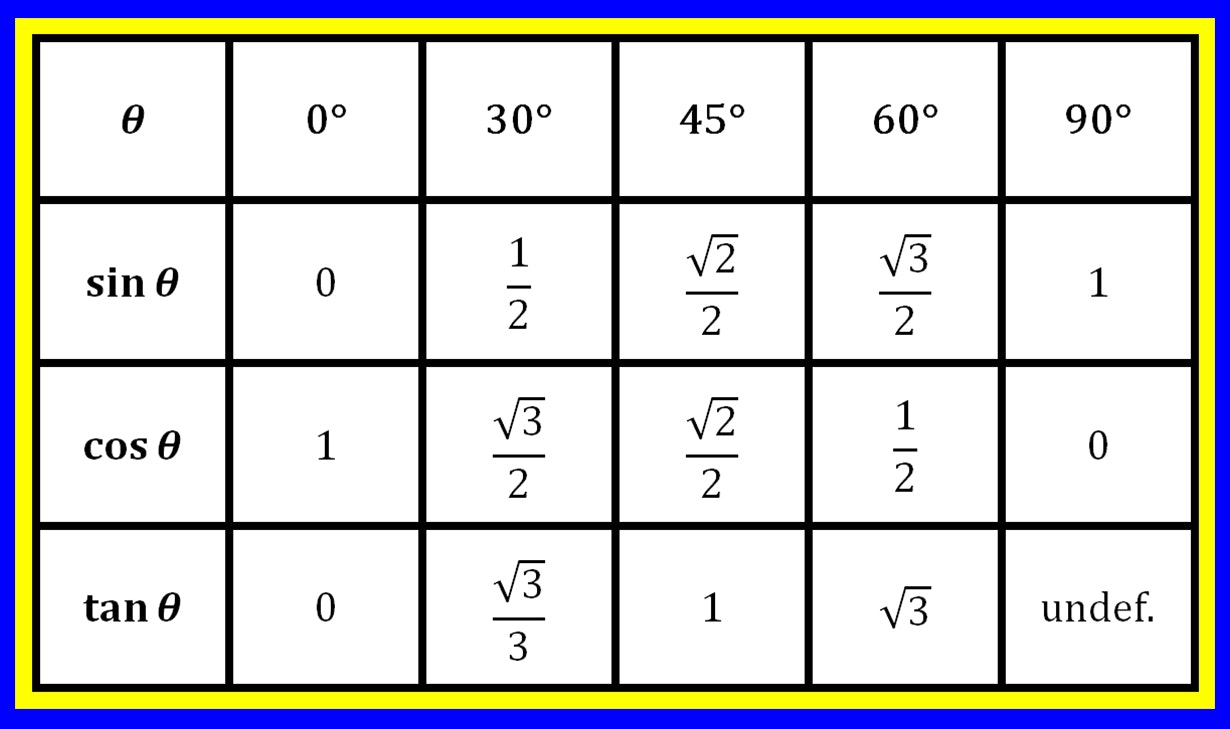


1. ***Interior (C) angle***

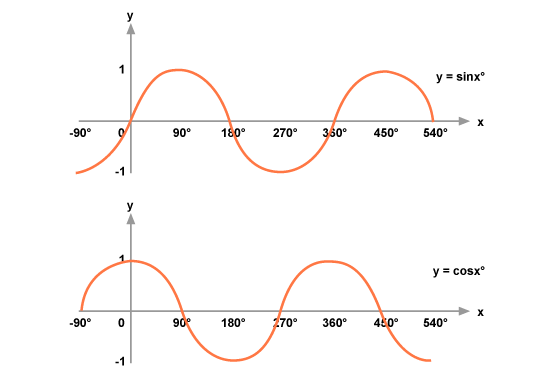
On parallel lines, co-interior (C) angles add up to 180°:

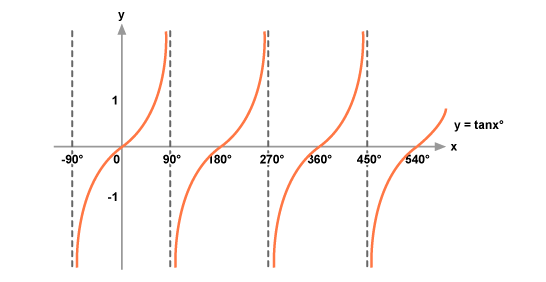


1. **Table for Sin, Cos & tan**

[](http://www.google.co.uk/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=2ahUKEwikxb73-bPaAhUR16QKHcd0CAYQjRx6BAgAEAU&url=http://cruzrich.com/sin-cos-tan-chart-uptodate/sin-cos-tan-chart-unorthodox-representation-trig-table-memory-tip-for-sine-cosine-and-tangent-of-special-angles-trigonometry/&psig=AOvVaw1eHALmbED4JVnxbJ2Hnwtz&ust=1523595542496626)

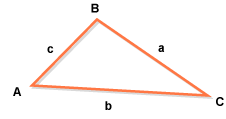
1. **Graph for Sin, Cos & tan**





1. **Sine Rule, Cosine Rule & Area of Triangle**
2. ***Sine Rule***

We can use the sine rule to find the size of an angle or length of a side.



The sine rule is:

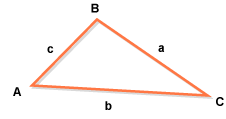
a over sinA = b over sinB = c over sinC

**OR**

sinA over a = sinB over b = sinC over c

1. ***The cosine rule***

We can use the cosine formula to find the length of a side or size of an angle.



For a triangle with sides a,b and c and angles A, B and C the cosine rule can be written as:

* a2 = b2 + c2 - 2bc cos A

**OR**

* b2 = a2 + c2 - 2ac cos B

**OR**

* c2 = a2 + b2 - 2ab cos C

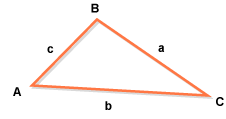
These formulae can be rearranged to give:

cos A = b to the power 2 + c to the power 2 - a to the power 2 over 2 b c

cos B = a to the power 2 + c to the power 2 - b to the power 2 divided by 2 a c

cos C = a to the power 2 + b to the power 2 - c to the power 2

1. ***The area of a triangle***



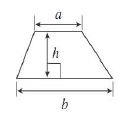
Area of triangle **ABC** = 1/2ab sin C

or, 1/2ac sin B

or, 1/2bc sin A

1. **Area**

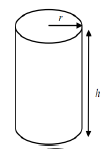
* **Square -------->** Area = Length2
* **Rectangle -------->**  Area = Length \* Width
* **Right-angled Triangle -------->** Area = ½ x Base \* Height
* **Other Triangle -------->** Area = ½ x Base \* Perpendicular Height
* **Circle -------->** Area = π \* r2
* **Trapezium -------->** Area = ½ ( a + b ) \* h



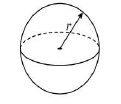
* **Parallelogram -------->** Area = base \* height

1. **Surface Area**

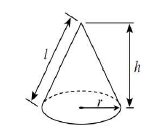
* **Curved Surface Area of a Cylinder -------->** Area = 2 \* π \* r \* h



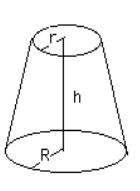
* **Surface area of a Sphere -------->** Area = 4 \* π \* r2



* **Total Surface area of a Cone -------->** π \* r \* l + π \* r2
* **Curved Surface area of a Cone -------->** Area = π \* r \* l

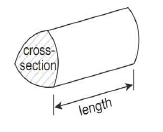


* **Frustum(Truncated Cone) -------->** Area = 

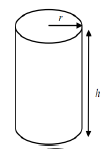


1. **Volume**

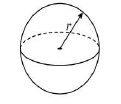
* **Cube -------->** Volume = Length3
* **Cuboid -------->** Volume = Length \* Width \* Height
* **Prism -------->** Volume = Area of Cross-section \* Length



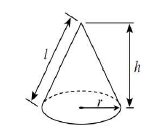
* **Cylinder -------->** Volume = π \* r2 \* h



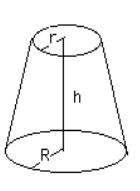
* **Sphere -------->** Volume = 4/3 \* π \* r3



* **Cone -------->** Volume = 1/3 \* π \* r2 \* h



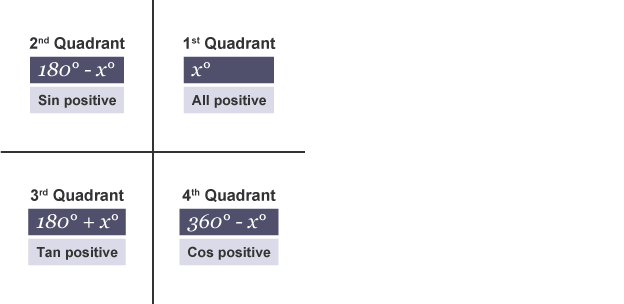
* **Frustum(Truncated Cone) -------->** Volume = πh/3 ( R2 + R\*r+ r2)



1. **Circumference or Perimeter**

* **Circle -------->** Circumference = 2 \* π \* r**OR**π \* D
* **Rectangle -------->** Perimeter = 2 ( Length + Width )

1. **CAST Diagram**



1. **Trigonometric Identities**

These are:

{\sin ^2}x + {\cos ^2}x = 1

cos2x = 1 - sin2x

sin2x = 1 - cos2x

And:

\tan A = \frac{{\sin A}}{{\cos A}}

1. **Differentiation**

The rule for differentiation is

f(x) = ax^n

f'(x) = nax^{n - 1}

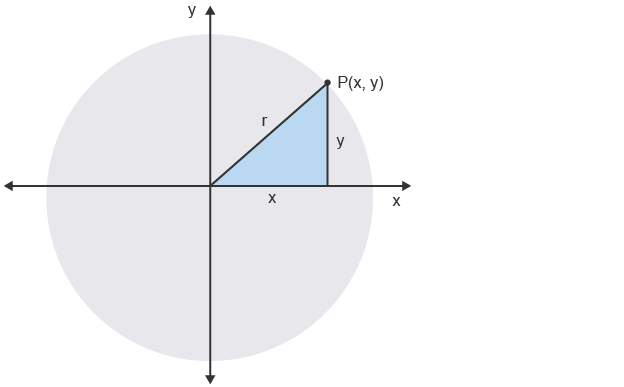
or, using the Leibniz notation

{d \over {dx}}(ax^n ) = nax^{n - 1}

1. **Equation of a circle**

The equation of a circle with radius r and centre (0, 0) is given by the formula

x^2 + y^2 = r^2



1. **Transformation of Graphs**
2. ***Translations parallel to the y-axis***

f(x) + a Represents a translation through the vector \begin{pmatrix} 0 \\ a \end{pmatrix}.

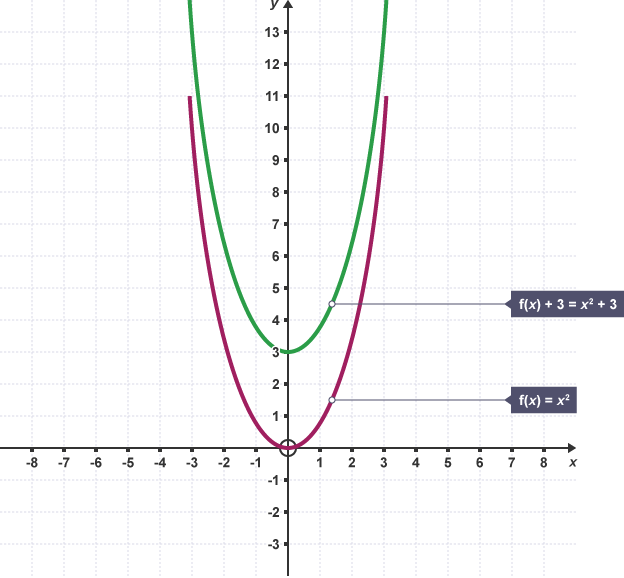
Iff(x) = x^2, thenf(x) + a = x^2 + a. Here we are adding ato the whole function.

The addition of the value arepresents a vertical translation in the graph. If ais positive, the graph translates upwards. If ais negative, the graph translates downwards.

**Example 1**

f(x) = x^2

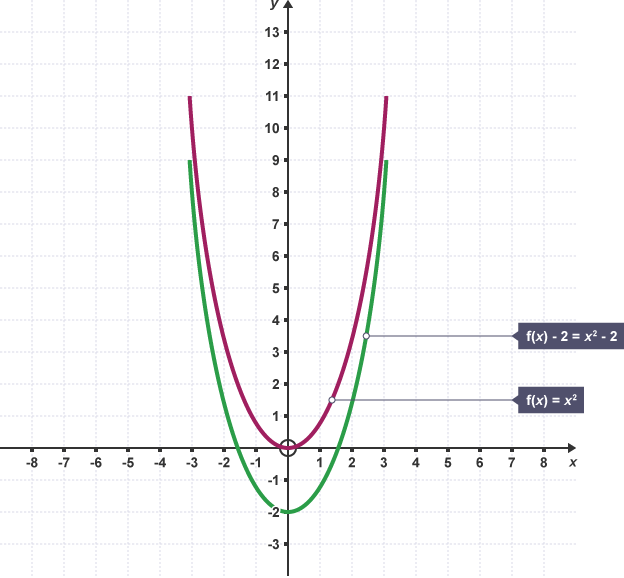
f(x) + 3 = x^2 + 3



**Example 2**

f(x) = x^2

f(x) - 2 = x^2 - 2



1. ***Translations parallel to the x-axis***

f(x + a) Represents a translation through the vector \begin{pmatrix} -a \\ 0 \end{pmatrix}.

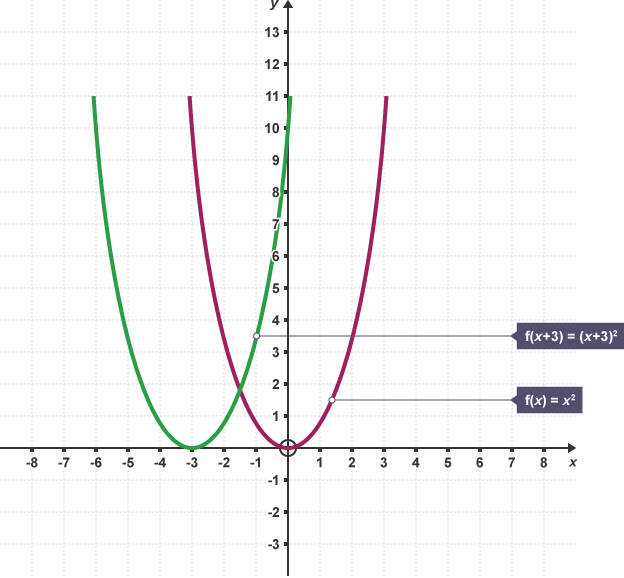
If f(x) = x^2 then f(x + a) = (x + a)^2.

Here we add ato x, not to the whole function. This time we will get a horizontal translation. If ais positive then the graph will translate to the left. If the value of ais negative, then the graph will translate to the right.

**Example 1**

f(x) = x^2

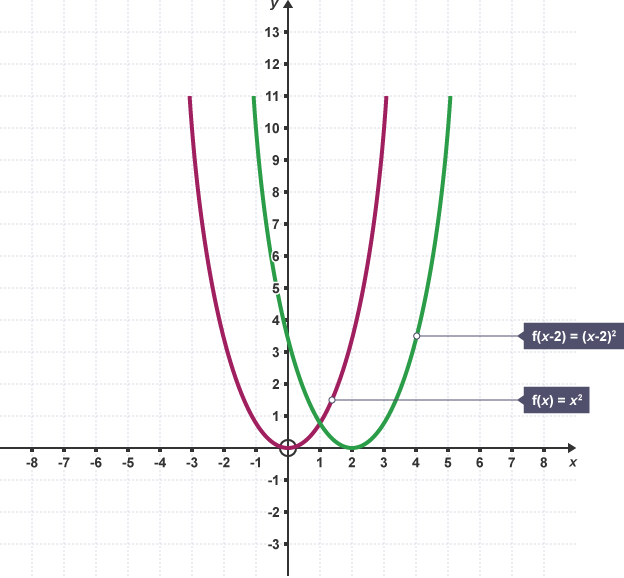
f(x + 3) = (x + 3)^2



**Example 2**

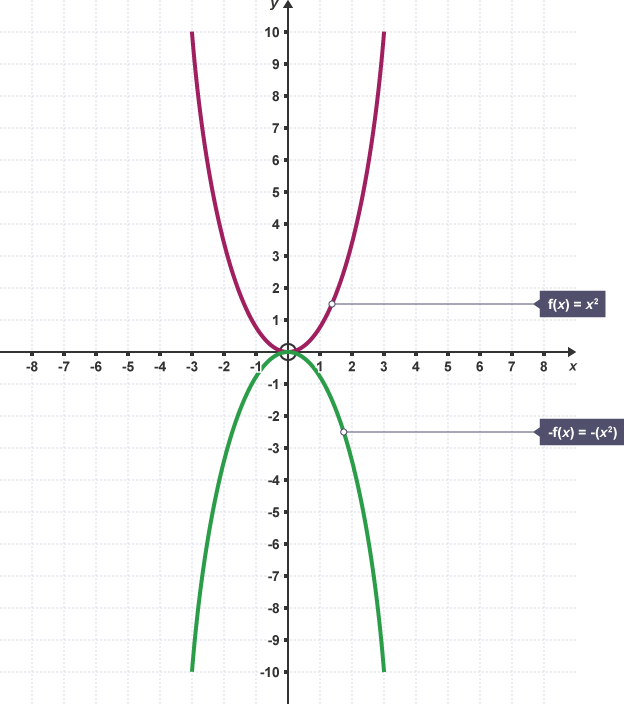
f(x) = x^2

f(x - 2) = (x - 2)^2



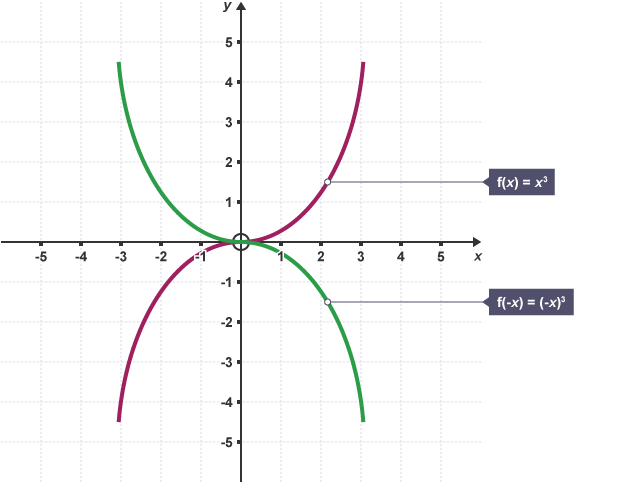
1. ***Reflections in the x-axis***

If f(x) = x^2, then -f(x) = -(x^2).



1. ***Reflections in the y-axis***

If f(x) = x^3, then f(-x) = (-x)^3.



## Summary

|  |  |
| --- | --- |
| y = f(x) + C | * C > 0 moves it up * C < 0 moves it down |
| y = f(x + C) | * C > 0 moves it left * C < 0 moves it right |
| y = Cf(x) | * C > 1 stretches it in the y-direction * 0 < C < 1 compresses it |
| y = f(Cx) | * C > 1 compresses it in the x-direction * 0 < C < 1 stretches it |
| y = −f(x) | * Reflects it about x-axis |
| y = f(−x) | * Reflects it about y-axis |