QUANT NOTES :

# Geometry & Coordinate Geometry.

-Selbi

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# Geometry

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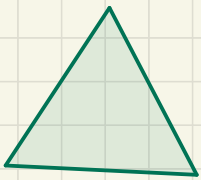
1)



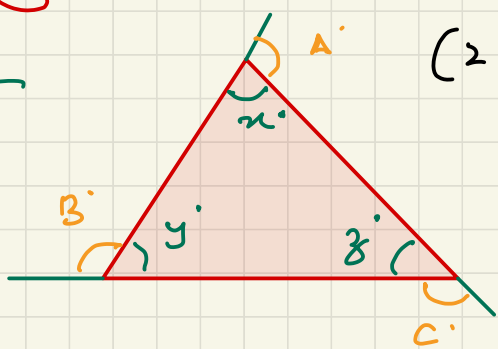
In a triangle sum of Lengths of any 2 sides > Length of 3rd side.

&

Difference of lengths of any 2 sides < Length of 3rd side

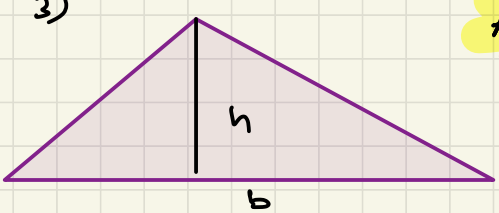
Sum of all interior angles = 180°

exterior = 360°

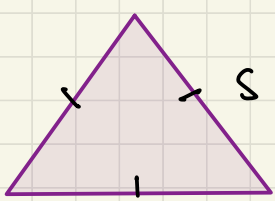



2)

## Areas




$$\text{area} = \frac{1}{2} \times b \times h$$




$$\text{area} = \frac{\sqrt{3}}{4} \text{ side}^2$$

4) → Sides of $30^\circ - 60^\circ - 90^\circ$ $\Delta$ are in the ratio of $1 : \sqrt{3} : 2$

→ Sides of $45^\circ - 45^\circ - 90^\circ$ $\Delta$ are in the ratio of $1 : 1 : \sqrt{2}$

→ Sides of $30^\circ - 30^\circ - 120^\circ$ $\Delta$ are in the ratio of

$1 : 1 : \sqrt{3}$

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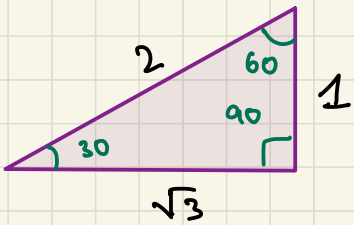
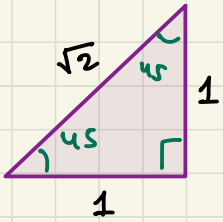
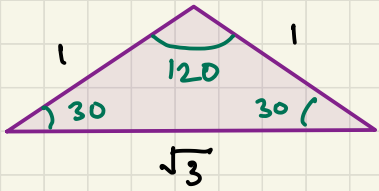


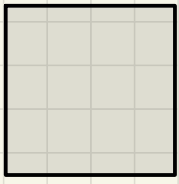

# Similarity of TRIANGLES

a) Sides are proportional, & angles are equal

b) Ratio of areas = (Ratio of Sides)$^2$

# For n-sided Polygon

a) Sum of all interior angles = $(n-2) \times 180^\circ$



→ $n = 4$

$(4-2) \times 180$

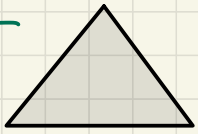
$2 \times 180$

$= 360^\circ$

$n = 3$ ←

$(3-2) \times 180$

$= 180^\circ$

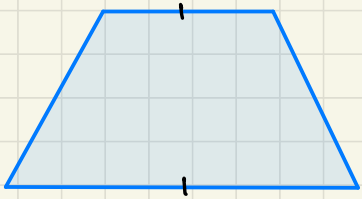


b) Sum of all exterior angles = 360

c) Number of diagonals = $\frac{n(n-3)}{2}$



# Different 4-sides FIGURES

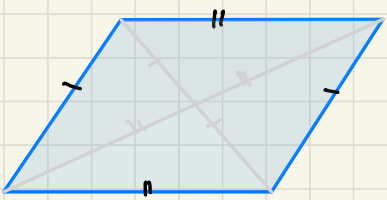


Trapezoid

→ Quadrilateral with one pair of parallel sides

- Parallel sides are called bases & non-parallel sides are called legs.

→ Area = $\frac{1}{2}$ × (sum of parallel sides) × (distance b/w them)

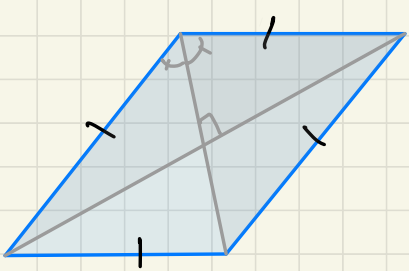


Parallelogram

→ Quadrilateral in which opposite sides are parallel

- Opposite angles & sides are equal
- diagonals bisect each other

→ Area = base × height



Rhombus

→ Parallelogram in which all sides are equal

- Diagonals are ⊥ to each other
- Diagonals are angle bisectors

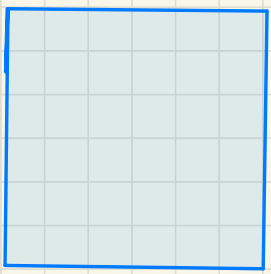
→ Area = $\frac{1}{2}$ × (product of diagonals)

Rectangle

→ Parallelogram in which all interior angles are equal

- Diagonals are equal

Area = length × breadth



Square

→ Parallelogram in which all interior angles and all sides are equal

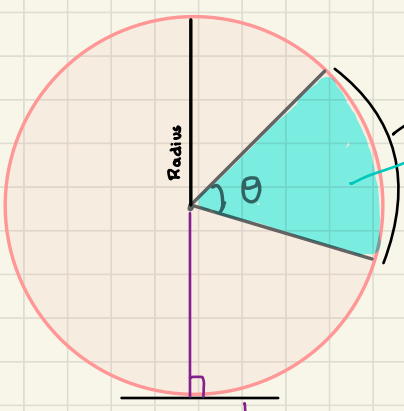
- All properties of rectangle & rhombus
- It is a regular quadrilateral

$$\text{Area} = (\text{side})^2 = \frac{1}{2}\,\text{diagonal}^2$$

# Circle

→ Circumference = $2\pi r$

→ Area = $\pi r^2$




→ Length of Arc = $\frac{\theta}{360} \times 2\pi r$

Area of a sector = $\frac{\theta}{360} \times \pi r^2$

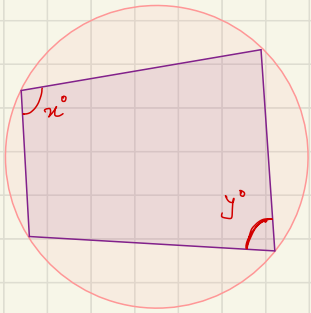
↳ Tangent is perpendicular to the radius drawn at the point of contact

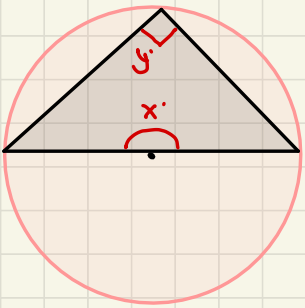
EXTRA

Two tangents drawn from any external point to a circle are of same length.

In a cyclic quadrilateral the sum of opposite angles is 180°.

$x° + y° = 180°$

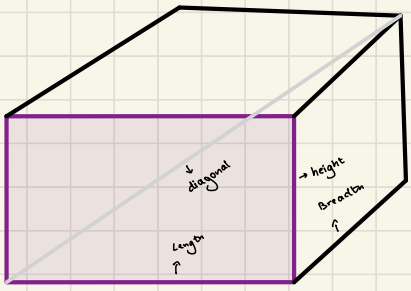



Angle subtended by an arc at the center, is twice of the angle subtended by the same arc on the remaining part of the circle. Angle subtended by an arc on the remaining part of the circle remains constant.

$\angle x = 2\angle y$

# 3D Figures




Cuboid

→ $d = \sqrt{l^2 + b^2 + h^2}$

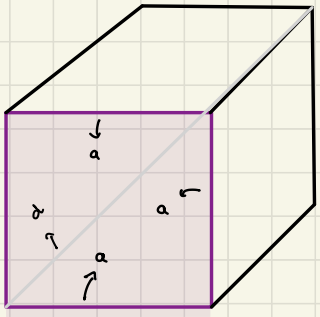
→ Volume = $l \times b \times h$

→ T. S. A = $2(lb + bh + lh)$

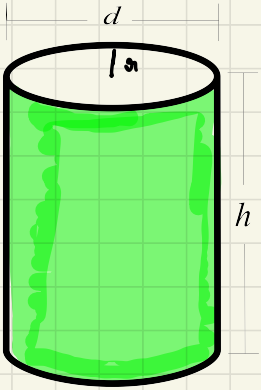
→ $d = \sqrt{3}\, a$

→ Volume $= a^3$

→ T.S.A $= 6a^2$




Cube




Cylinder

→ Volume $= \pi r^2 h$

→ T.S.A $= 2\pi r(h + r)$

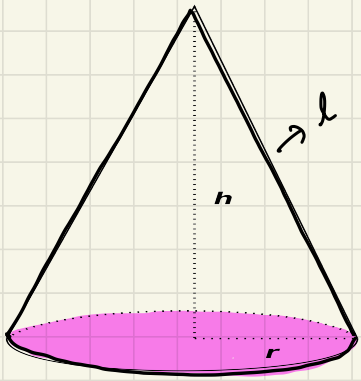
→ C.SA $= 2\pi r h$

→ $l = \sqrt{r^2 + h^2}$

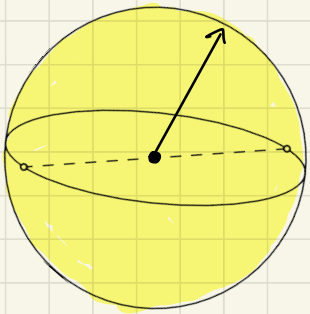
→ Volume $= \frac{1}{3} \pi r^2 h$

→ T.S.A $= \pi r (l + r)$

→ C.S.A $= \pi r l$




Cone



Sphere

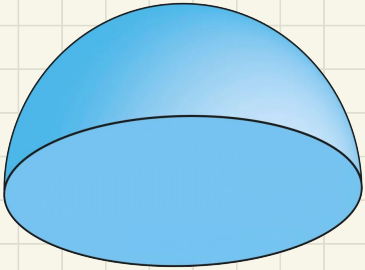
→ Volume = $\frac{4}{3}\pi r^3$

→ T.SA = $4\pi r^2$

→ Volume = $\frac{2}{3}\pi r^3$

→ T.SA = $3\pi r^2$

→ C.S.A = $2\pi r^2$



Hemisphere

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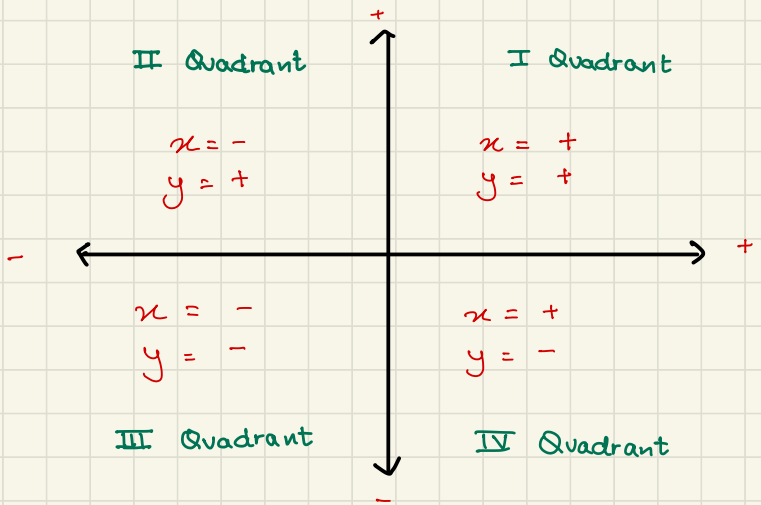
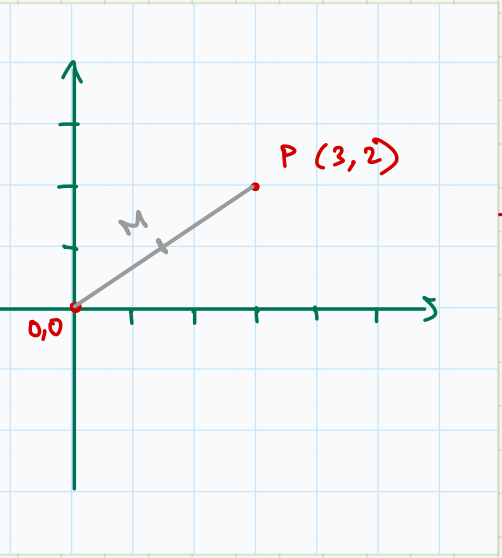
# Coordinate Geometry




→ Distance b/w two points P & Q

$$= \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

→ Let P = (3,2) & Q = (0,0)

$$\text{Distance} = \sqrt{(3-0)^2 + (2-0)^2}$$

$$= \sqrt{13}$$

→ Coordinates of midpoint P & Q

$$= \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}$$

$\rightarrow M = \left(\frac{3+0}{2}, \frac{2+0}{2}\right)$

$= (1.5, 1)$

# What Are Slopes?

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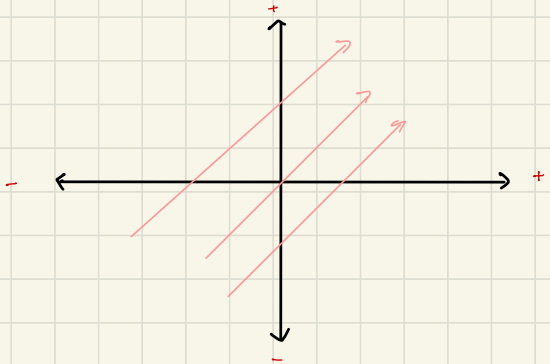
The slope of a line on the coordinate plane basically tells you how steep the line is. If you know the rise and run of a line, you can calculate its slope using the slope formula.

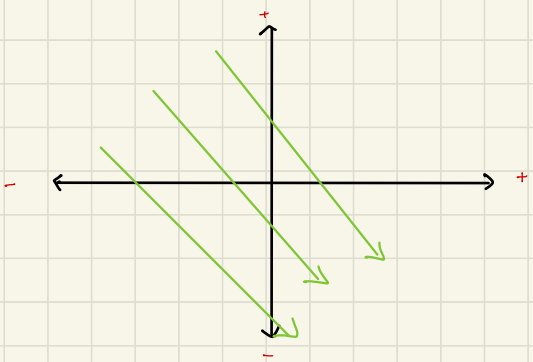
$$m = \frac{\text{Change in } y \text{ coordinates}}{\text{Change in } x \text{ coordinates}} = \frac{y_1 - y_2}{x_1 - x_2}$$

How slope is denoted



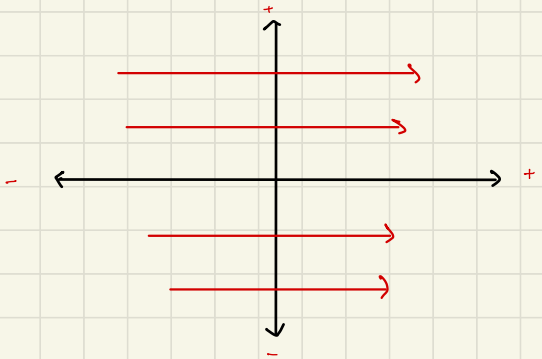

$m > 0$

When lines are ascending.



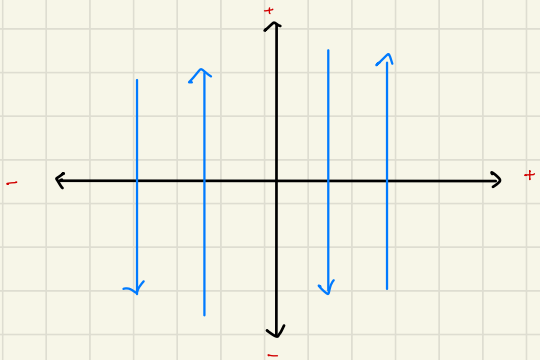

$m < 0$

When lines are descending



$m = 0$

for any line parallel to the x- axis.



$m$ = not defined

for any line parallel to the y- axis

- Parallel lines : Slopes are equal $m_1 = m_2$
- Perpendicular lines : Product of slopes is $-1$
  $m_1 \times m_2 = -1$

What is the equation of a line?

$$y = mx + c$$

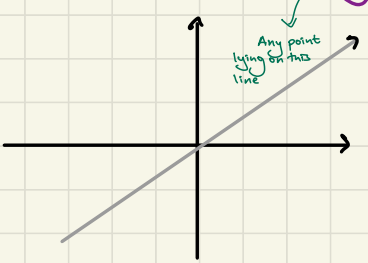
slope

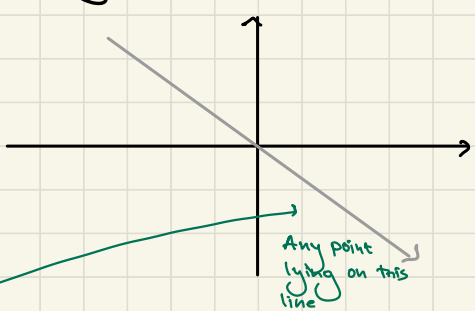
y-intercept of the line

- x intercept is x-coordinate of the point where y coordinate is zero.
- y intercept is y-coordinate of the point where y coordinate is zero.
- If line passes through origin, x intercept = y intercept = 0

## Mirror Image & Rotation

- Reflection about x-axis = change the sign of y coordinate
- Reflection about y-axis = change the sign of x coordinate
- Reflection about $y = x$ : Interchange the x & y co-ordinate




- Reflection about $y = -x$ : Interchange the x & y coordinate & change the sign of x & y

- When a point is rotated about origin by 90° then interchange the x & y coordinates, and their will depend on the quadrant in which the point lies

## Functions

Linear Functions = $Y = mX + C$

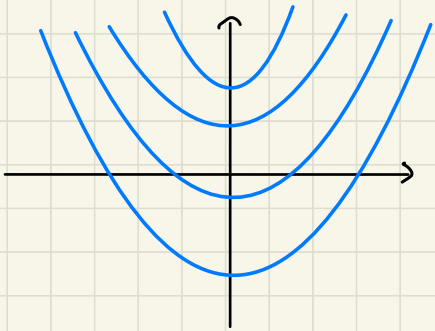
$f(x)$

Quadratic Functions = $Y = aX^2 + bX + C$

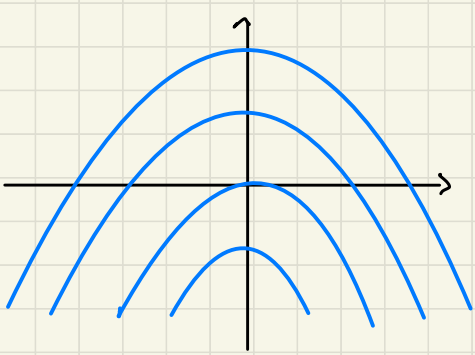
↓ This equation represents a parabola.

↓ This shows if parabola lies in +y-axis or -y axis

$a > 0$

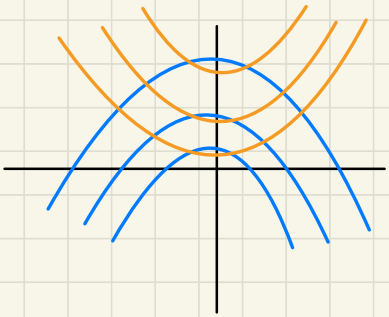


$a < 0$



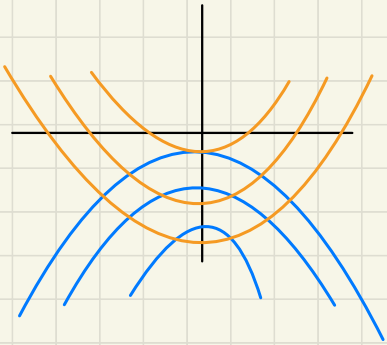
a signifies if the parabola is U-shaped or inverted U-shape.

C (+)



all parabolas whether a>0 or a<0 lie in the (+) y axis

C (-)



all parabolas whether a>0 or a<0 lie in the (-) y axis

Try out this question:

Does the graphical representation of the quadratic function, f(x) =y=Ax^2+C, intersect with X axis?

1) A<0
2) C>0

zoom in for the answer

Let's try out one more question

!

answer is C

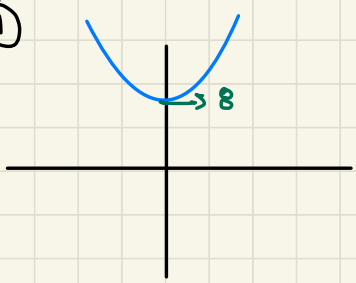
For the parabola Y =X^2 - 6X +8 in the XY plane find the following:

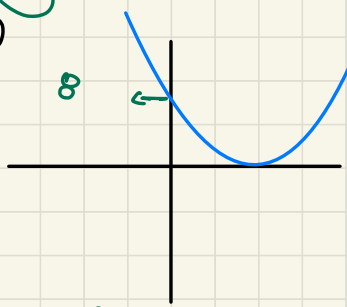
a) The x intercepts
b) The y intercept
c) Axis of symmetry
d) Coordinates of the Vertex.

a) Now the equation is $y = x^2 - 6x + 8$

You should already understand that here $a > 0$ & $c = (+)\,8$

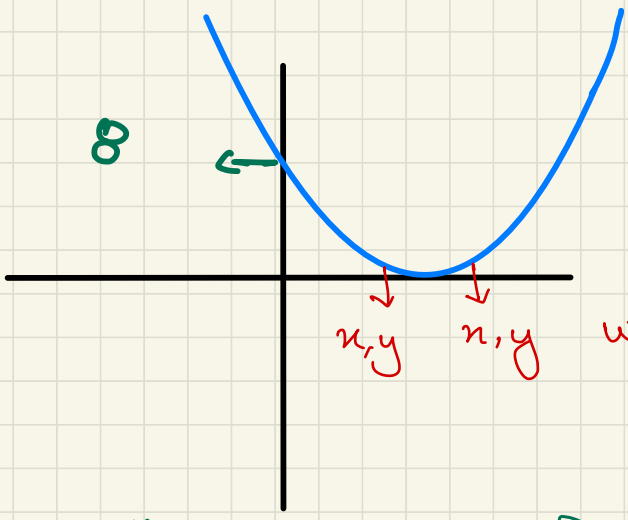
So you can imagine two ways this can be drawn

① 


② 


Because we are looking for x intercepts we will go with ②

Please note that this is not the final representation of the graph




So the equation will become $0 = x^2 - 6x + 8$

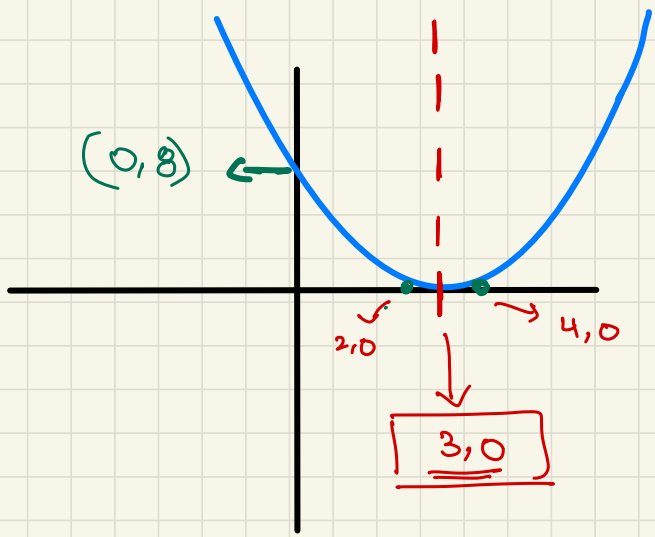
$$0 = (x-2)(x-4)$$

$$\boxed{x = 2 \qquad x = 4}$$

b) You can directly find out the y-intercept from the equation $Ax^2 + bx + C$ where C is the y-intercept.

Hence answer is (+8)

c) Axis of symmetry can be known by finding out the midpoint of the x-coordinates.




d) Coordinates of the vertex can be found by adding the x-coordinate of midpoint to the equation.

$x = 3$

$y = x^2 - 6x + 8$

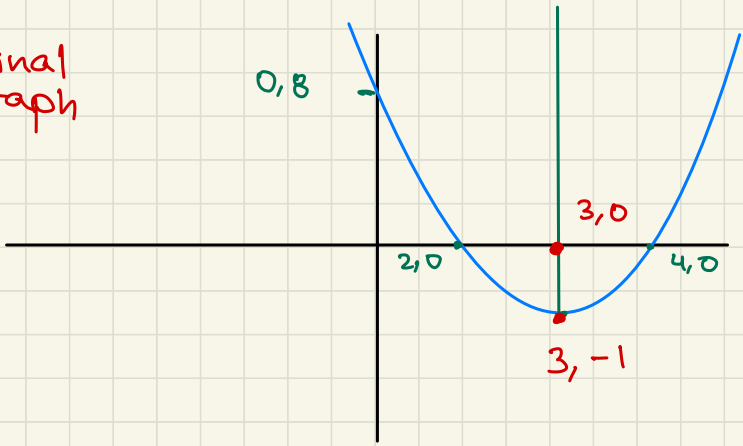
$y = 3^2 - 6(3) + 8$

$y = 9 - 18 + 8$

$y = -1$

→ so coordinate is $(3, -1)$

→ Final graph




## Equations of a circle

$$R^2 = (X - h)^2 + (Y - k)^2$$

→ where $(h, k)$ is the centre of the circle

→ $R$ is the radius of the circle

Note: If the center of the circle is at the origin, then the equation of the circle will be

↓

$$(x)^2 + (y)^2 = R^2$$