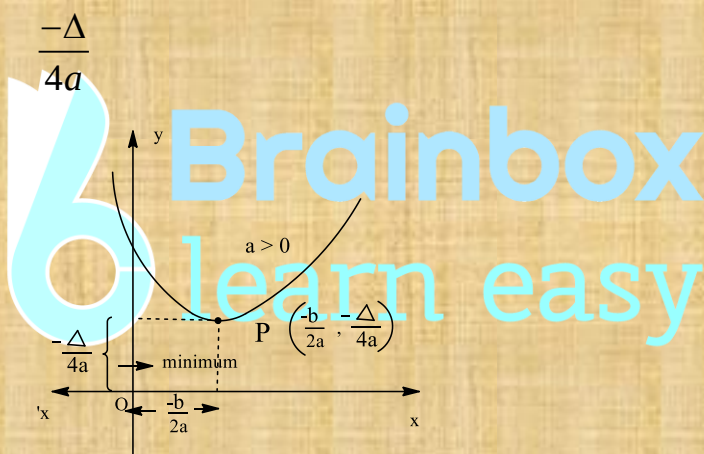


Chapter **5**

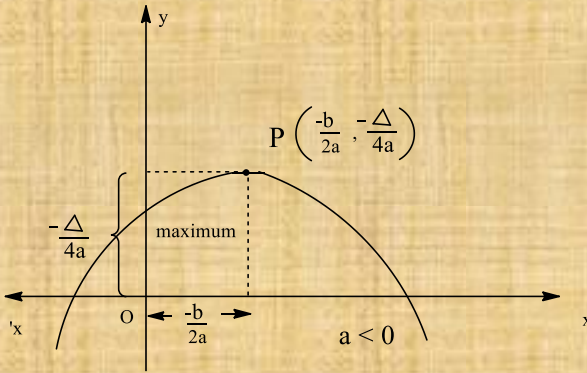
COMPLEX NUMBERS AND QUADRATIC EQUATIONS

Maximum and minimum values (External values) of quadratic equation:

- For $a > 0$, $y = ax^2 + bx + c$ attains its minimum value at the point with abscissa $x = \frac{-b}{2a}$ and value equal to



- For $a < 0$, $y = ax^2 + bx + c$ attains its maximum value at the point with abscissa $x = \frac{-b}{2a}$ and the value equal to $\frac{-\Delta}{4a}$



Eg: Find max/min of the expression $x^2 - 5x + 6$.

Here $a=1, b=-5, c=6$ and

$$\begin{aligned}\Delta &= b^2 - 4ac = (-5)^2 - 4(1)(6) \\ &= 25 - 24 = 1\end{aligned}$$

Since $a=1 > 0$, it attains minimum Value

$$\text{Equal} = \frac{-\Delta}{4a} = \frac{-1}{4(1)} = \frac{-1}{4}$$

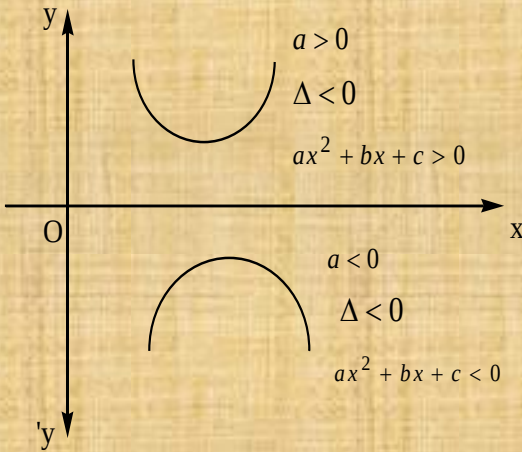
❖ Find the maximum or minimum value of the quadratic expression. $2x - 7 - 5x^2$

Sol: Coefficient of $x^2 = -5 < 0 \Rightarrow 2x - 7 - 5x^2$ has maximum

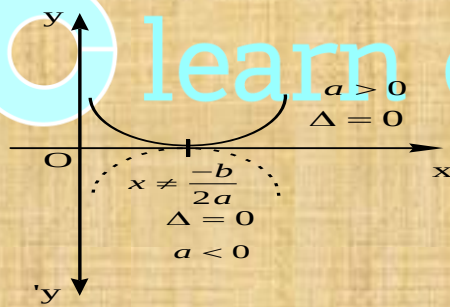
$$\begin{aligned}\text{Max. value} &= \frac{-\Delta}{4a} = \frac{-\left((2)^2 - 4(-5)(-7)\right)}{4a} \\ &= \frac{-[4 - 140]}{-20} = \frac{-4 + 140}{-20} = \frac{136}{-20} = \frac{-34}{5}\end{aligned}$$

Sign of the quadratic expression $ax^2 + bx + c$

1. If the roots of $ax^2 + bx + c = 0$ are imaginary, then for $x \in R$, $ax^2 + bx + c = 0$ and 'a' have the same sign.

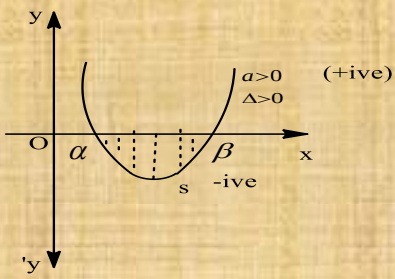


2. If the roots of $ax^2 + bx + c = 0$ are real and equal then $ax^2 + bx + c$ and 'a' will have same sign.

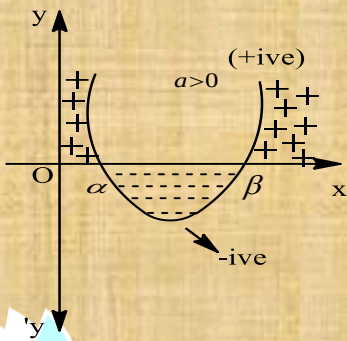


3. Let α, β be the real roots of $ax^2 + bx + c = 0$ and $\alpha < \beta$ then

(i) $x \in R, \alpha < x < \beta \Rightarrow ax^2 + bx + c$ and 'a' have the opposite signs.



(ii) $x \in R$, $x < \alpha$ or $x > \beta \Rightarrow ax^2 + bx + c$ and 'a' have the same sign.



Brainbox
learn easy