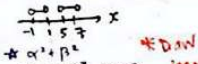
QUADRATIC FUNCTIONS

→ When bx in ax^2+bx+c is 0, line of symmetry is $x=0$ $(0,-)$ ★

→ $x+hx \Rightarrow (x+\frac{h}{2})^2-(\frac{h}{2})^2 \Rightarrow a(x+h)^2+k$ [turning pt. : $\underset{\text{opp. sign}}{h,k}$] e.g. $x^2-8x : (x-\frac{8}{2})^2-(-\frac{8}{2})^2$ $= (x-4)^2-16$

→ After completing the square : $(x-3)^2=3 \Rightarrow x-3 = \pm\sqrt{3} \Rightarrow x=3\pm\sqrt{3}$ turning pt : $(4,-16)$

→ Formula : $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$; Equation : $y=\underline{a}(x+2)(x-6)$ * coefficient may NOT be 1 ! $y=a(x+p)(x-q)$ $x=\frac{p+q}{2}$

→ Draw FINAL number line for quadratic inequalities : 

→ $\alpha+\beta=-\frac{b}{a}$; $\alpha\beta=\frac{c}{a}$; $x^2-(\alpha+\beta)x+(\alpha\beta)=0$ ★ $\alpha^2+\beta^2 = (\alpha+\beta)^2-2\alpha\beta$ * Draw graph for inequalities!

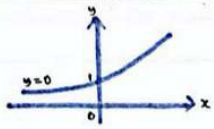
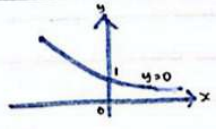
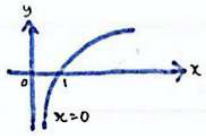
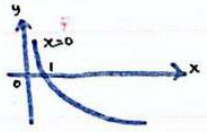
→ Discriminant : b^2-4ac : $D>0 \Rightarrow$ real ; distinct ; $D=0 \Rightarrow$ real ; equal

→ For 'show' questions, find discriminant, then put : $=-8$ <0

→ +ve range : $D<0$, $a>0$; -ve range : $D<0$, $a<0$

→ 3 variables : ① $y=x+c$ is tangent to ② $y=2x^2-4xy+y^2-8$ → sub. ① into ②

EXPONENTIAL ; LOGARITHMIC FUNCTIONS

	$a>1$	$0<a<1$
① Graph of Expo. Func.* $y=a^x$, $a>0$, $a\neq1$ → when $x=0$, $y=1$ → Asymptote : $y=0$		
② Graph of Log. Func.* $y=\log_a x$, $a>0$, $a\neq1$ → when $y=0$, $x=1$ → Asymptote : $x=0$		

→ $e^{-x}=\frac{1}{e^x}$ | $e^x \times e^y = e^{x+y}$ | $\frac{e^x}{e^y}=e^{x-y}$ | $e^0=1$ | $e^{\frac{m}{n}}=\sqrt[n]{e^m}$ | $e^x=e^y \Rightarrow x=y$

→ $y=\log_a x$ where $a>0$, $a\neq1$, $x>0$; $a^x=K \Leftrightarrow \log_a K=x$ $\therefore \log_a x=\log_a y \Rightarrow x=y$ * coefficients must be 1

→ Laws of logarithms :

① $\log_a x+\log_a y=\log_a(xy)$ ③ $\log_a(x^n)=n(\log_a x)$

② $\log_a x-\log_a y=\log_a(\frac{x}{y})$ ④ $\log_c b=\frac{\log_a b}{\log_a c}$

⑤ $\log_a x=\frac{1}{\log_x a}$ ⑥ $\log_a a=1$ $\log_a 1=0$

→ Sub. values of unknown variables into equation to check if they are +ve

→ Let '$u=e^x$' / '$u=\log_e x$' if cannot solve in expo. or log. form ⇒ quad. eqn.

→ Graph of $y=a^x$ reflects $y=\log_a x$ about $y=x$

* Graph : ① axes, ② '0', ③ intercepts, ④ asymptote, ⑤ equation