M. Yousuf Tariq   AS - B3 - Grp. D

1

Maths: Formula Sheet

Date: 4 / 12 / 24

Ch# 1, 2, 3, 4, 5, 6

$x^2 + 2dx + c \to (x+d)^2 - d^2 + c$

$x^2 - 2dx + c \Rightarrow (x-d)^2 - d^2 + c$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$b^2 - 4ac \to$ discriminant $\Rightarrow$ >0, $=0$, <0, ≥ 0

>0 → 2 sol. → 2 points of intersection; $=0$ → 1 sol. → tangent; <0 → no sol. → does not touch; ≥ 0 → has a solution → intersects

$a^2 - b^2 = (a+b)(a-b)$

$x = -\frac{b}{2a}$

Completing square form → comparing coefficients

$\sqrt{ab} = \sqrt{a} \times \sqrt{b}$

$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

$\sqrt{a \pm b} \neq \sqrt{a} \pm \sqrt{b}$

Ch 1

$(ax+b)^2 + c \Rightarrow$ T.P $(-b, c)$

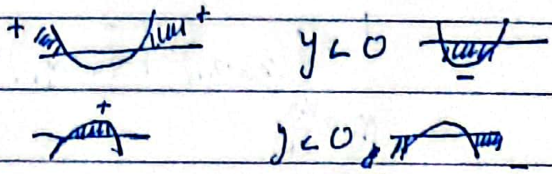
$a(x+b)^2 + c \to$ T.P $(-b, c)$

$(x+b)^2 + c \Rightarrow$ T.P $(-b, c)$

Disguised quadratic $\Rightarrow$ Let $m = x^n$

Critical values: x^2: $y > 0$, $y < 0$

$-x^2$: $y > 0$, $y < 0$



Vertical line test ⇒ check if graph is a function

Horizontal line test ⇒ check if function has an inverse

One-to-one, Many-to-one] function

One-to-many] relation

Ch 2

Domain & range: square bracket ⇒ $\leq$ $\geq$

Parenthesis ⇒ $>$ $<$

Ch 2

Composite functions

RIDO ⇒ $R_{inner} \subseteq D_{outer}$

$D_{composite} \subseteq D_{inner}$

$R_{composite} \subseteq R_{outer}$

Function composition $fg(x)$ is possible when all outputs of g are valid input for f.

Self-inverse function ⇒ function = inverse

domain of $f(x)$ ⇒ range of $f^{-1}(x)$

range " " ⇒ domain " "

$f^{-1}(x)$ ⇒ reflection of $f(x)$ on $y = x$ ⇒ (a,b) on $f(x)$, (b,a) on $f^{-1}(x)$

$f(x-a)$ ↳ $\binom{a}{0}$ translate

$f(x)+a$ ↳ $\binom{0}{a}$ translate

$af(x)$ ↳ stretch parallel to y-axis sf a.

$f(ax)$ ↳ stretch parallel to x-axis sf $\frac{1}{a}$

$y = -f(x)$ ↳ reflection on x-axis

$y = f(-x)$ ↳ reflection of y-axis

vertical transformation ⇒ BODMAS ⇒ stretch, reflect, translate

horizontal " ⇒ opp. " ⇒ translate, reflect, stretch

combination ⇒ any of ~~the first~~ horizontal/vertical first

Ch 3

$$\text{Midpoint} = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

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

$$m = \frac{\Delta y}{\Delta x}$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$Ax + By = C$$

$m_1 \times m_2 = -1$ ⇒ perp. lines

$m_1 = m_2$ ⇒ parallel lines

$(x-a)^2 + (y-b)^2 = r^2$ ⇒ circle with centre (a,b) & radius r

A of kite, trapezium $= \frac{1}{2} \times$ product of diagonal lengths

Date : / /

Ch4

π rad = 180°

$S = r\theta$

$A = \frac{1}{2} r^2 \theta$

$$\theta_{degrees} = \frac{\theta_{rad} \times 180}{\pi}$$

$$\theta_{rad} = \frac{\theta_{degrees} \times \pi}{180}$$

Ch4

	30°	45°	60°
sin θ	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$
cos θ	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$
tan θ	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$

(reverse order)

tan θ: sin θ ÷ cos θ

Ch5

SOH CAH TOA

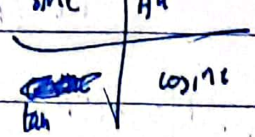
$\sin\theta = \frac{opp.}{hyp.}$

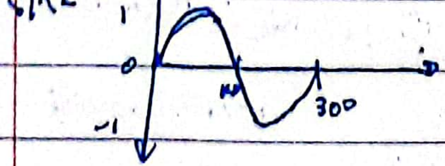
$\cos\theta = \frac{Adj.}{hyp.}$

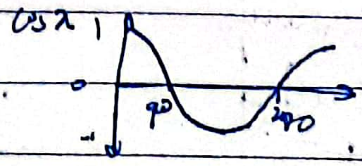
$\tan\theta = \frac{opp.}{adj.}$

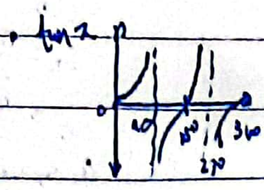
ref-angle : acute from x-axis

trick: All Science Teachers Crazy









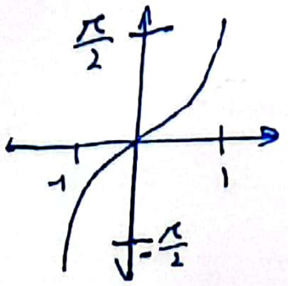
transformations ⇒ same as Ch 2

$y = A(\sin B(x+C))+D$

↳ Amplitude ↳ $\frac{2\pi}{B}$ = Period ↳ phase shift ↳ principal axis

Ch3

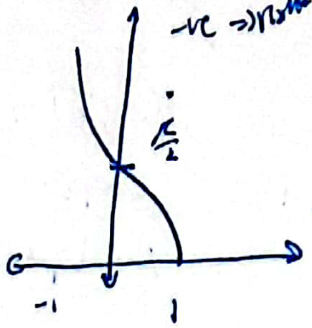
$\sin^{-1}(x)$



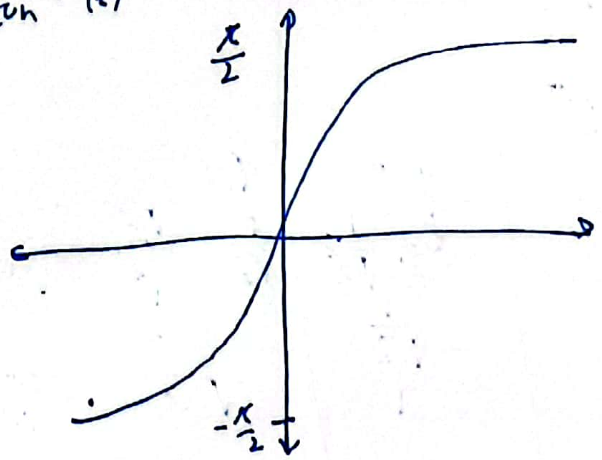
$\cos^{-1}(x)$

+ve ⇒ left

-ve ⇒ right



$\tan^{-1}(x)$



$\tan\theta = \frac{\sin\theta}{\cos\theta}$

$\cos^2\theta + \sin^2\theta = 1$

Ch6

pascal's triangle

```
      1
     1 1
    1 2 1
   1 3 3 1
      ⋮
```

$(a+b)^n = \binom{n}{0}(a)^n(b)^0 + \binom{n}{1}(a)^{n-1}(b)^1 + \dots + \binom{n}{n}(a)^0(b)^n$

$\binom{n}{r} = \frac{n!}{r!\,(n-r)!}$

trick eg. $r=2$: $\frac{n(n-1)\cancel{(n-2)!}}{2!\,\cancel{(n-2)!}} = \frac{n(n-1)}{2!}$

~~∴ expand above~~

$a_n = a+(n-1)d$ ⇒ arithmetic

$S_n = \frac{n}{2}[2a+(n-1)d]$

$S_n = \frac{n}{2}[a+l]$

$d = a_2-a_1 = a_3-a_2 \dots$

$S_1 = a$

$a_n = ar^{n-1}$

$S_n = \frac{a(1-r^n)}{(1-r)}$ ⇒ geometric

$S_\infty = \frac{a}{1-r}$

$r = \frac{a_2}{a_1} = \frac{a_3}{a_2} \dots$