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DS-B

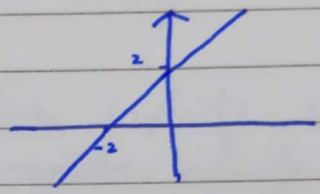
Date 6th Sep 2023

Calculus Assignment

1. $f(x) = \frac{x^2-4}{x-2}$

$= \frac{(x)^2-(2)^2}{x-2} = \frac{\cancel{(x-2)}(x+2)}{\cancel{(x-2)}} = x+2$

$f(x) = x+2$



x-int
$0 = x+2$
$x = -2$

y-int
$y = 2$

Domain $(-\infty, +\infty)$, No holes in the graph

2. $g(x) = x^3 - 4x^2 + 3x + 6$

$g(-x) = (-x)^3 - 4(-x)^2 + 3(-x) + 6$
$g(-x) = -x^3 - 4x^2 - 3x + 6$

$g(-x) \neq g(x)$ so not even

$-g(x) = -x^3 + 4x^2 - 3x - 6$

$g(-x) \neq -g(x)$ so not odd.

3. $f(x) = \lfloor x \rfloor$

$$f(x) = \begin{cases} n, & n \leq x < n+1 \\ 0, & 0 \leq x < 1 \\ -1, & -1 < x < 0 \end{cases}$$

Date

4. $f(x) = \sqrt{2x+3}$

Domain

$2x+3 \geq 0$

$x \geq \frac{-3}{2}$

Range

$R\ [0, +\infty)$

$f(x) = y$

$y = \sqrt{2x+3}$

$\frac{y^2-3}{2} = x$

$f^{-1}(y) = x$

$f^{-1}(y) = \frac{y^2-3}{2}$

$f^{-1}(x) = \frac{x^2-3}{2}$

Domain

$[0, +\infty)$

Range

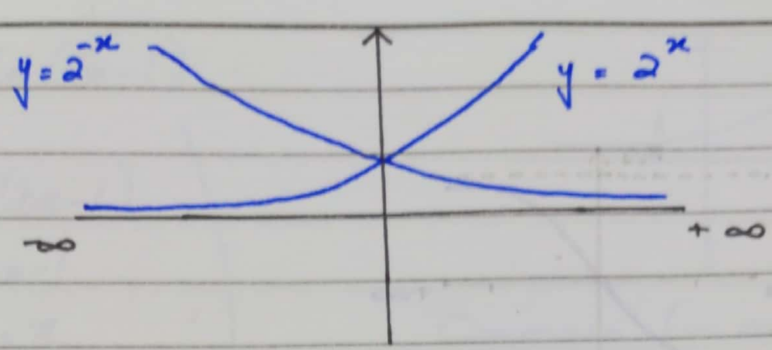
$[\frac{-3}{2}, +\infty)$

5. $fg(x) = \left(\frac{1}{x}\right)^2 + 3\left(\frac{1}{x}\right)$

$fg(x) = \frac{1}{x^2} + \frac{3}{x}$

Domain : $x \in R$, $x \neq 0$

Date



For $y = 2^{-x}$, as it reaches negative infinity it increases however decreases when approaching positive infinity.

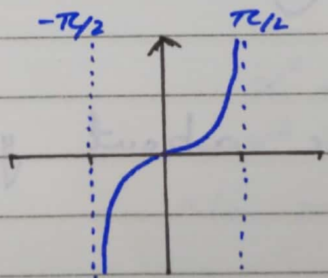
For $y = 2^{x}$, as it reaches positive infinity it increases however decreases when approaching negative infinity

7. $gf(x) = \sin(\log_{10}(x))$

→ $\sin x$ is defined for all real numbers
→ $\log_{10} x$ is defined for all positive real numbers

Domain $(0, +\infty)$

8. $f(x) = \tan x$

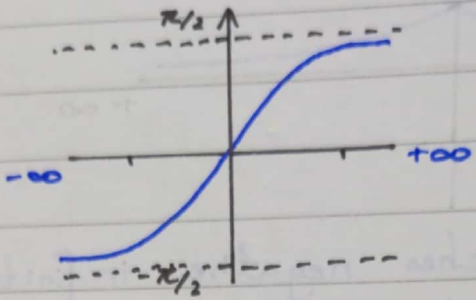


Domain $\{ : \mathbb{R} \setminus \{(2n+1)(\frac{\pi}{2})\}$ Range $(-\infty, +\infty)$

Restricted Domain for 1-1 function:

$D(-\frac{\pi}{2}, \frac{\pi}{2})$

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



Domain $(-\infty, +\infty)$ Range $(-\frac{\pi}{2}, \frac{\pi}{2})$

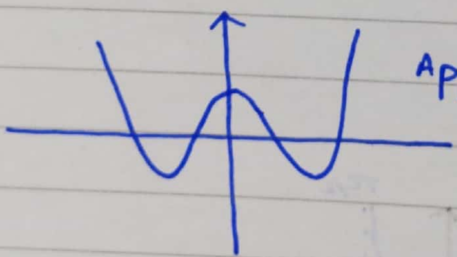
9. $g(x) = x^4 - 3x^2 + 2$

$g(-x) = (-x)^4 - 3(-x)^2 + 2$ $-g(+x) = -x^4 + 3x^2 - 2$

$g(x) = x^4 - 3x^2 + 2$

$g(-x) = g(x)$ $-g(x) \neq g(-x)$

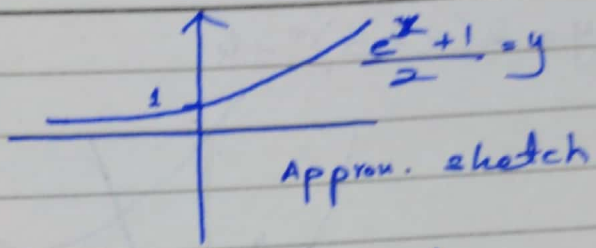
* Max power 4 so 4 roots



Approximate graph

The graph is symmetric about y-axis so it is even

Date



$f(x) = \ln(2x-1)$

$f(x) = y$

$y = \ln(2x-1)$

$e^y = 2x-1$

$\frac{e^y+1}{2} = x$

$f^{-1}(y) = x$

$f^{-1}(y) = \frac{e^y+1}{2}$

$f^{-1}(x) = \frac{e^x+1}{2}$

$2x-1 > 0$

$x > \frac{1}{2}$

Domain $(-\infty, +\infty)$

Range $(\frac{1}{2}, +\infty)$

ii. $gf(x) = \sqrt{3\left(\frac{x}{x^2+1}\right)+2}$

$gf(x) = \sqrt{\frac{3x}{x^2+1}+2}$

$g(x) = \sqrt{3x+2}$

$3x+2 \geq 0$

$x \geq -\frac{2}{3}$

$f(x) = \frac{x}{x^2+1}$

$x^2+1 > 0$

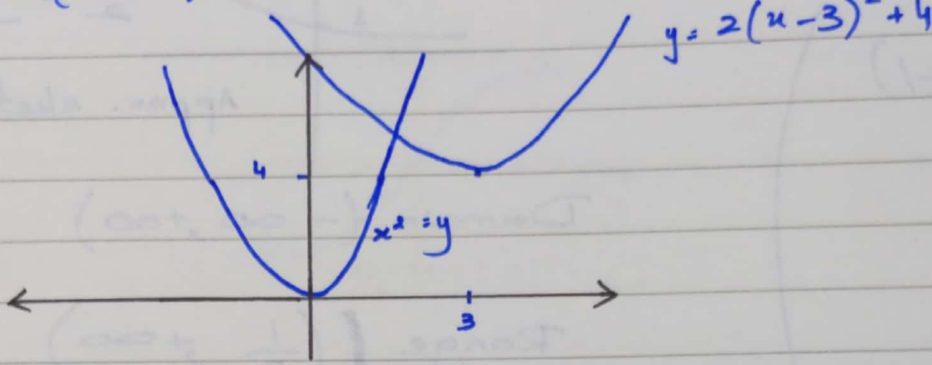
$x^2 > -1$

No real solutions

Cannot find domain as function is not real

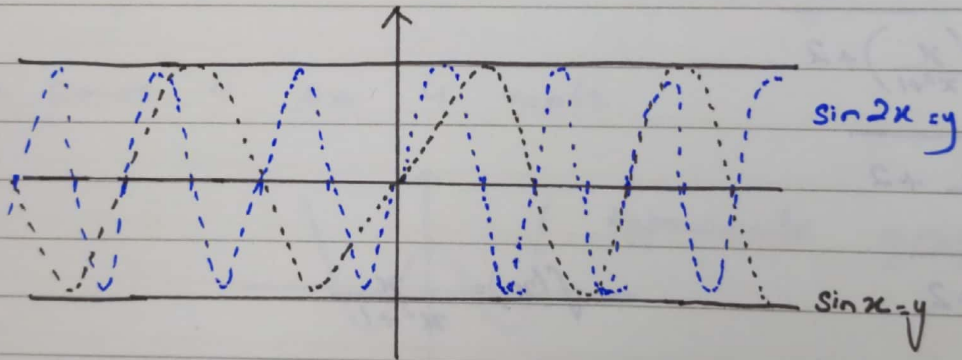
Date

12(a) $y = 2(x-3)^2 + 4$



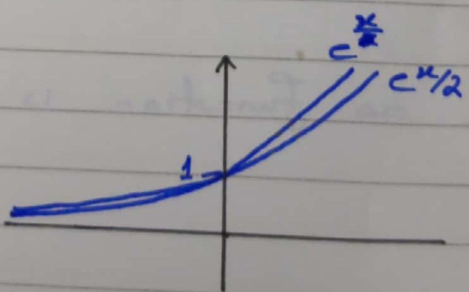
1. Shift graph horizontally right by 3 units
2. Shift graph vertically up by 4 units
3. Stretch graph vertically by factor of 2.

(b)= $y = \sin(2x)$



→ Stretch graph by factor ~~By~~ of $\frac{1}{2}$ horizontally

(c) $y = e^{x/2}$



→ Stretch graph by factor of $\frac{1}{2}$ horizontally