MATHEMATICS SPECIALIST UNIT 3&4 **Name** SOLUTIONS.

TEST 1, 2016

You must show all working

Section One: Resource Free

Time: 22 minutes

Total marks: 22

---

1. [5 marks]

State if the following equations below are functions. For those that are functions state their natural domain.

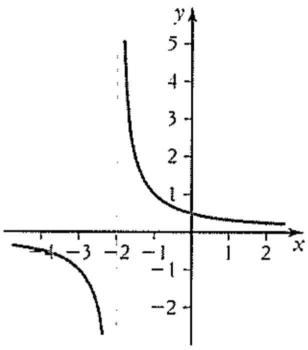
a) $f(x) = \frac{2}{x+1}$ Is a function ✓ Domain: $x \in \mathbb{R}, x \neq -1$ ✓

b) $f(x) = \pm\sqrt{x-2}$ Is not a function ✓

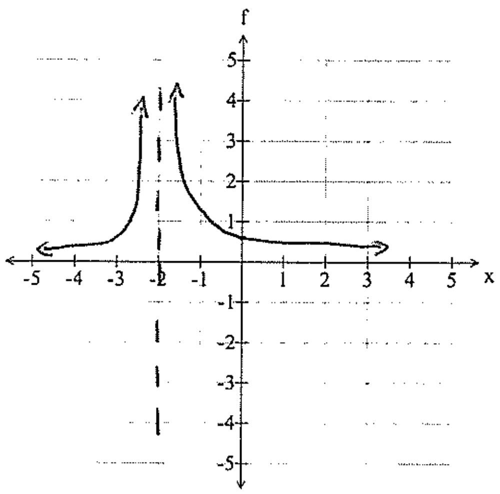
c) $f(x) = \ln(x-2)$ Is a function ✓ Domain: $x \in \mathbb{R}, x > 2$ ✓.

2. [1, 1, 1 marks]

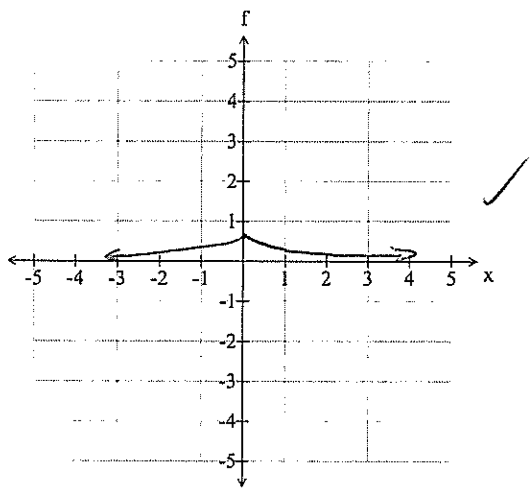
Using the function below as y=f(x)



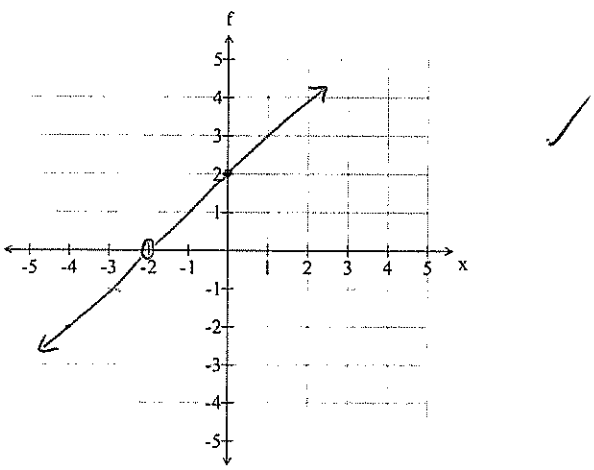
a) Sketch y=|f(x)| on the set of axes.



b) Sketch y=f(|x|) on the set of axes.



c) Sketch $y = \dfrac{1}{f(x)}$ on these axes



3. [2, 2, 3 marks]

Let $f(x)=2x-5$ and $g(x)=\dfrac{2}{3-x}$. Determine

a) the defining rule for $gof(x)$ = $\dfrac{2}{3-(2x-5)}$ ✓

$= \dfrac{2}{8-2x}$. ✓

b) the range of $fog(x)$.

$y \in \mathbb{R} : y \neq -5$ ✓✓

c) the value of $g^{-1}(4)$.

$x = \dfrac{2}{3-y}$

$3-y = \dfrac{2}{x}$. ✓

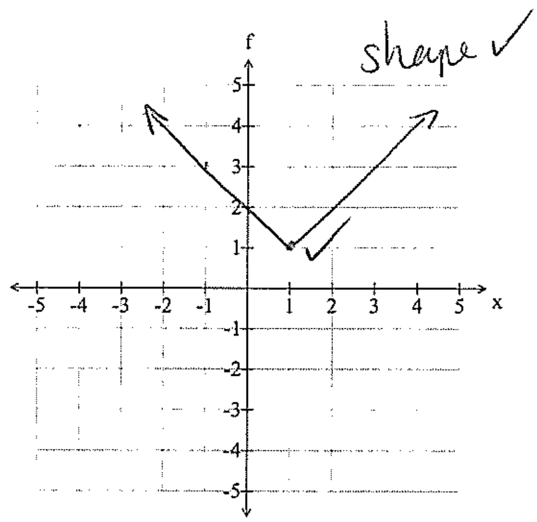
$y^{-1} = 3-\dfrac{2}{x}$. ✓

$\therefore g^{-1}(4) = 2\frac{1}{2}$. ✓

4. [2 marks]

Sketch the graph of f(x)=|x-1|+1

on the axes



5. [5 marks]

Sketch the graph of $f(x) = \dfrac{x^2 - 2x + 3}{x - 1}$

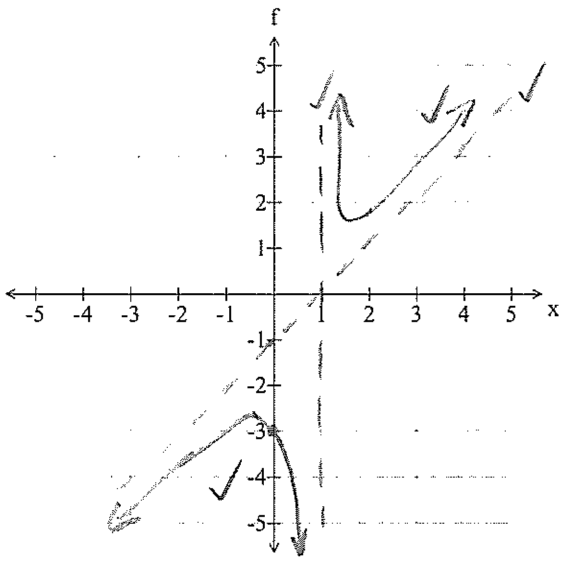
When $x = 0$ $y = -3$.

$x \to +\infty$ $y \to +\infty$

$x \to -\infty$ $y \to -\infty$.

$x \to 1^+$ $y \to +\infty$.

$x \to 1^-$ $y \to -\infty$.



$$\begin{array}{r} x - 1 \\ x-1 \overline{)\, x^2 - 2x + 3} \\ - \underline{x^2 - x} \\ -x + 3 \\ - \underline{-x + 1} \\ 2 \end{array}$$

$\therefore$ Oblique asymptote $y = x - 1$.

MATHEMATICS SPECIALIST UNIT 3&4 Name SOLUTIONS.

TEST 1, 2016

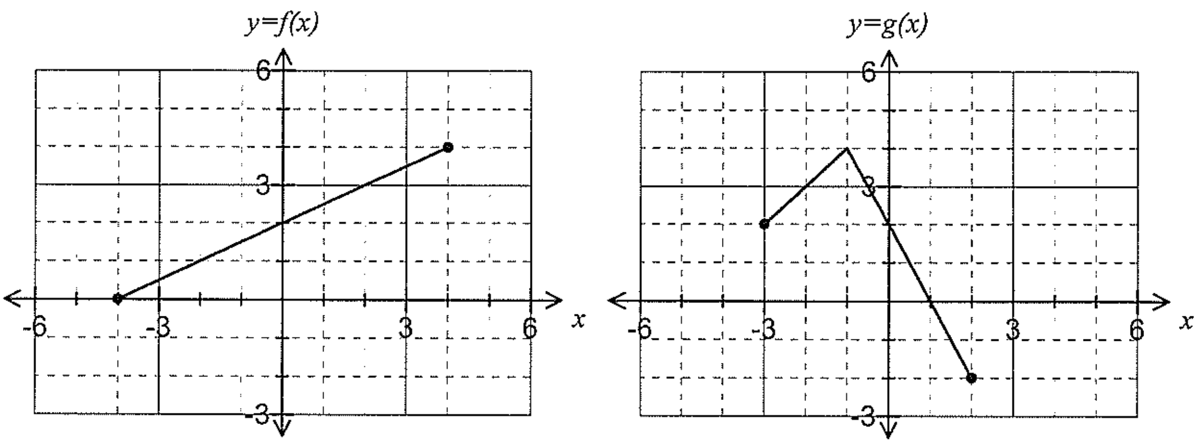
You must show all working

Section Two: Resource Rich

Time: 20 minutes Total marks: 20

---

6. [1, 2, 1, 2 marks]
The graphs of $y = f(x)$ and $y = g(x)$ are shown below over their respective domains.



a) Determine

(i) $f(2)$. $= 3$ ✓

(ii) $(f \circ g)(2)$. $= 1$ ✓✓

b) Determine

(i) the range of $g(x)$.

$-2 \leq y \leq 4$ ✓

(ii) the domain for which $g \circ f(x)$ is defined.

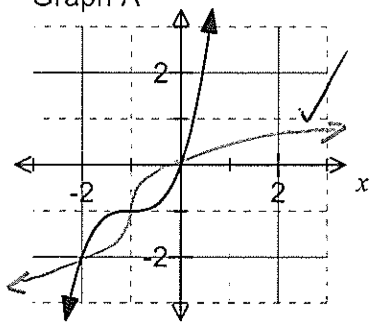
Range of $f(x)$ must be restricted to be ✓
within the domain of $g(x)$

$x: -4 \leq x \leq 0$ ✓

7. [5 marks]

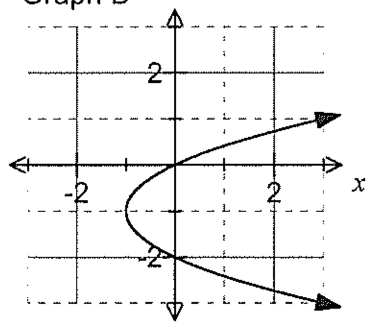
For each graph below that shows a function, on the same axes sketch the inverse function. For those that do not show a function, clearly indicate which graph(s) and briefly give your reasoning in the space below the graph.

Graph A



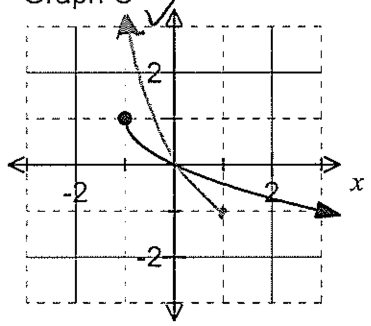
Is a function ✓

Graph B



Graph B is not a function as it is a one to many relationship. ✓

Graph C



Is a function ✓

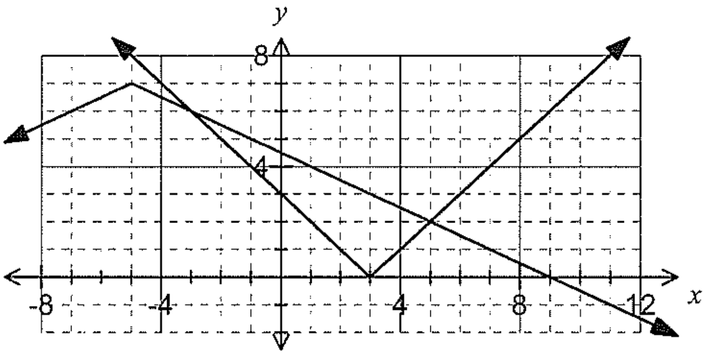
8. [2, 2, 2, 3 marks]

a) Solve $|7-3x| = c$, giving your solution(s) in terms of c.

$7 - 3x = \pm c$

$x = \dfrac{7 \pm c}{3}$

b) The graphs of $f(x) = |x-3|$ and $g(x) = 7 - \left|\dfrac{x}{2} + \dfrac{5}{2}\right|$ are shown below.



(i) Solve $g(x) = f(4)$. $f(4) = 1$

$g(x) = 1$ $x = -17$ and $x = 7$

(ii) Solve $|x-3| \geq 7 - \left|\dfrac{x}{2} + \dfrac{5}{2}\right|$

$x \geq 5$ and $x \leq -3$.

(iii) Given that the solution to $|ax+b| = 7 - \left|\dfrac{x}{2} + \dfrac{5}{2}\right|$ is $-5 \leq x \leq 9$, determine all possible values for a and b.

$a = 0.5$
$b = -4.5$

or

$a = -0.5$
$b = 4.5$