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VCE Mathematical Methods ½
Functions & Relations II [2.2]
Homework

Homework Outline:

Compulsory Questions	Pg 2 – Pg 15
Supplementary Questions	Pg 16 – Pg 27

Section A: Compulsory Questions

Sub-Section [2.2.1]: Find Domain and Range of Functions

Question 1

For the function $f(x) = \sqrt{x+3}$, find its:

a. Maximal domain.

b. Range.

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Question 2

For the function $f : (-2, 3] \to \mathbb{R}, f(x) = (x-1)^2 + 2$, find its:

a. Maximal domain.

b. Range.

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Question 3

For the function $f : [-6, -3) \to \mathbb{R}, f(x) = \log_3(x^2 - 9)$, find its:

a. Maximal domain.

b. Range.

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Question 4 Tech-Active.

For the function $f(x) = 3\sqrt{\frac{x+2}{x-1}}$, find its:

a. Maximal domain.

b. Range.

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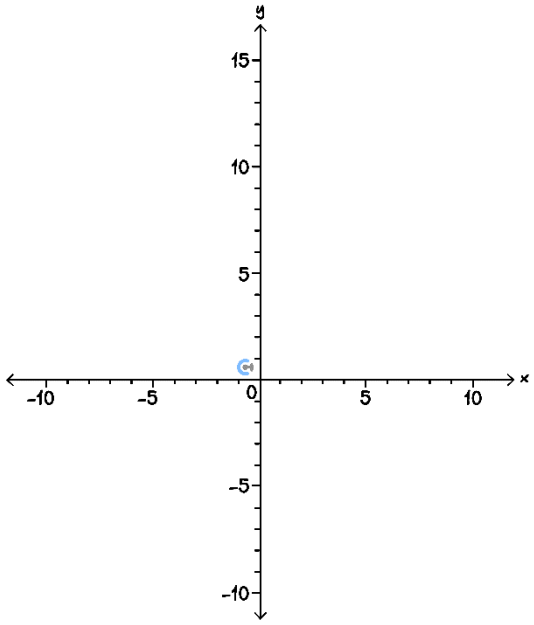
Sub-Section [2.2.2]: Sketch and Find the Domain and Range of Hybrid Functions

Question 5

Consider the hybrid function g.

$$g(x) = \begin{cases} (x-3)^2 - 4, & x \geq 1 \\ \frac{x}{2} + 8, & x < 1 \end{cases}$$

a. Sketch the graph $y = g(x)$.



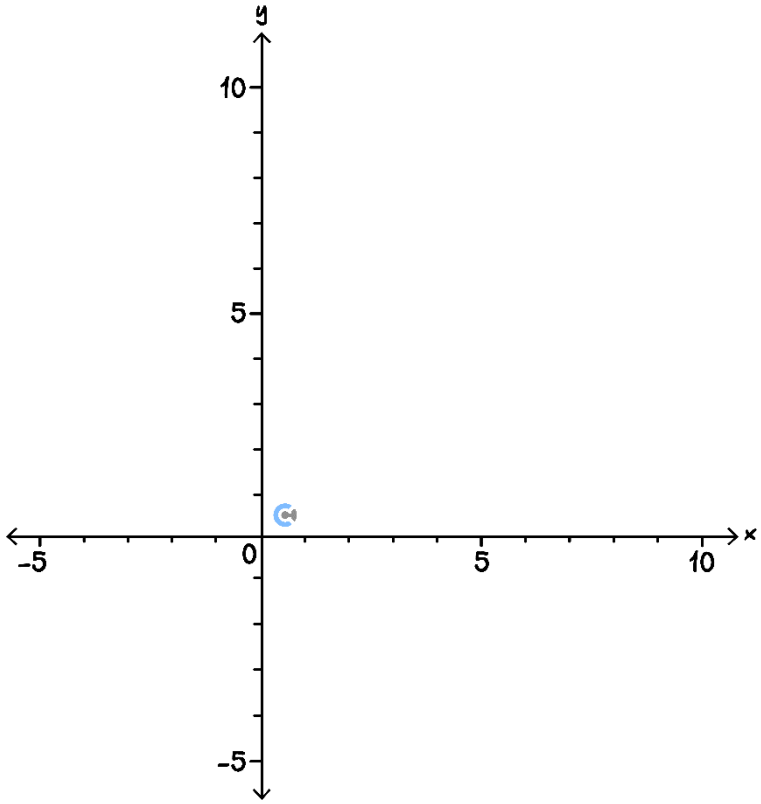
b. Find the range of $g(x)$.

Question 6

Consider the hybrid function g.

$$g(x) = \begin{cases} 2x + 3, & -1 \leq x \leq 3 \\ 21 - 4x, & 3 < x < 4 \\ \frac{1}{2}x + 3, & 4 \leq x \leq 6 \end{cases}$$

a. Sketch the graph $y = g(x)$.



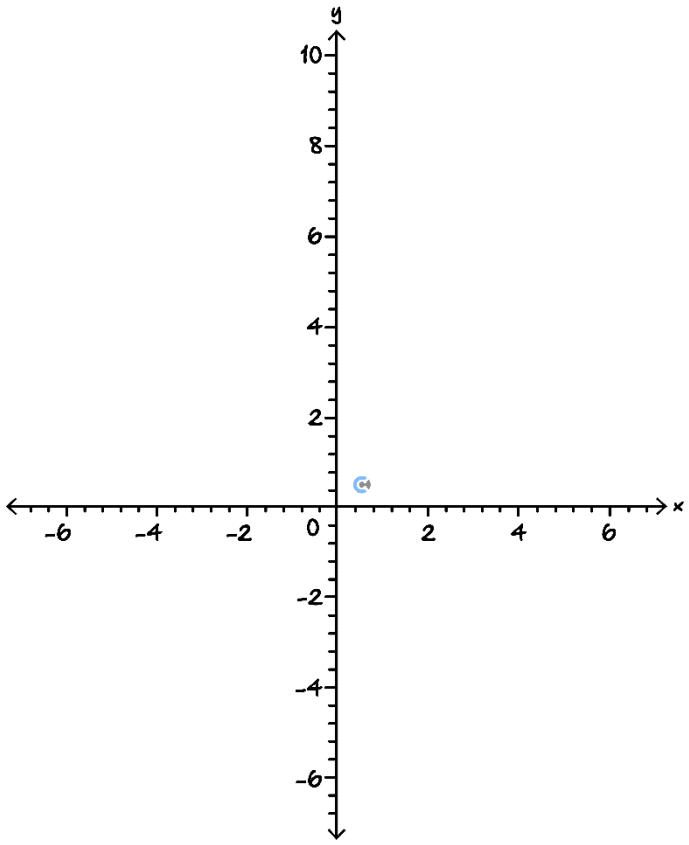
b. Find the range of $g(x)$.

Question 7

Consider the hybrid function g.

$$g(x) = \begin{cases} -\dfrac{2}{x+3} - 1, & x < -1 \\ -x^2 - 2x - 2 & x > -1 \end{cases}$$

a. Sketch the graph $y = g(x)$.



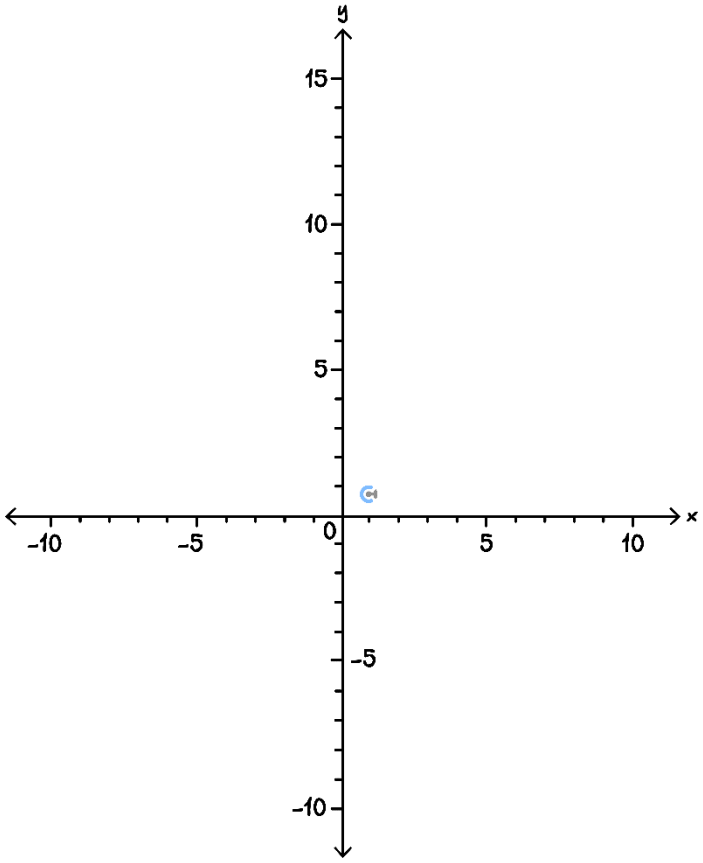
b. Find the range of $g(x)$.

Question 8 Tech-Active.

Consider the hybrid function g.

$$g(x) = \begin{cases} (x+1)^2 + 2, & x \geq -1 \\ -7 - 2x, & x < -1 \end{cases}$$

a. Sketch the graph $y = g(x)$.



b. Find the range of $g(x)$.

Sub-Section [2.2.3]: Find the Rule, Domain, Range, and Intersections between Inverse Functions

Question 9

Consider the function $f(x) = 4x - 1$.

a. Find the rule for the inverse function f^{-1}.

b. State the domain and range of f^{-1}.

c. Find the coordinates for any points of intersection between f and f^{-1}.

Question 10

Consider the function $f : [-2, 4] \to \mathbb{R}, f(x) = -3x + 1$.

a. Find the rule for the inverse function f^{-1}.

b. State the domain and range of f^{-1}.

c. Find the coordinates for any points of intersection between f and f^{-1}.

Question 11

Consider the function $f(x) = -2\sqrt{4-x} + 5$.

a. Find the rule for the inverse function f^{-1}.

b. State the domain and range of f^{-1}.

c. Find the coordinates for any points of intersection between f and f^{-1}.

Question 12 Tech-Active.

Consider the function $f(x) = \frac{1}{x-5} + 2$.

a. Find the rule for the inverse function f^{-1}.

b. State the domain and range of f^{-1}.

c. Find the coordinates for any points of intersection between f and f^{-1}.

Sub-Section: Final Boss

Question 13

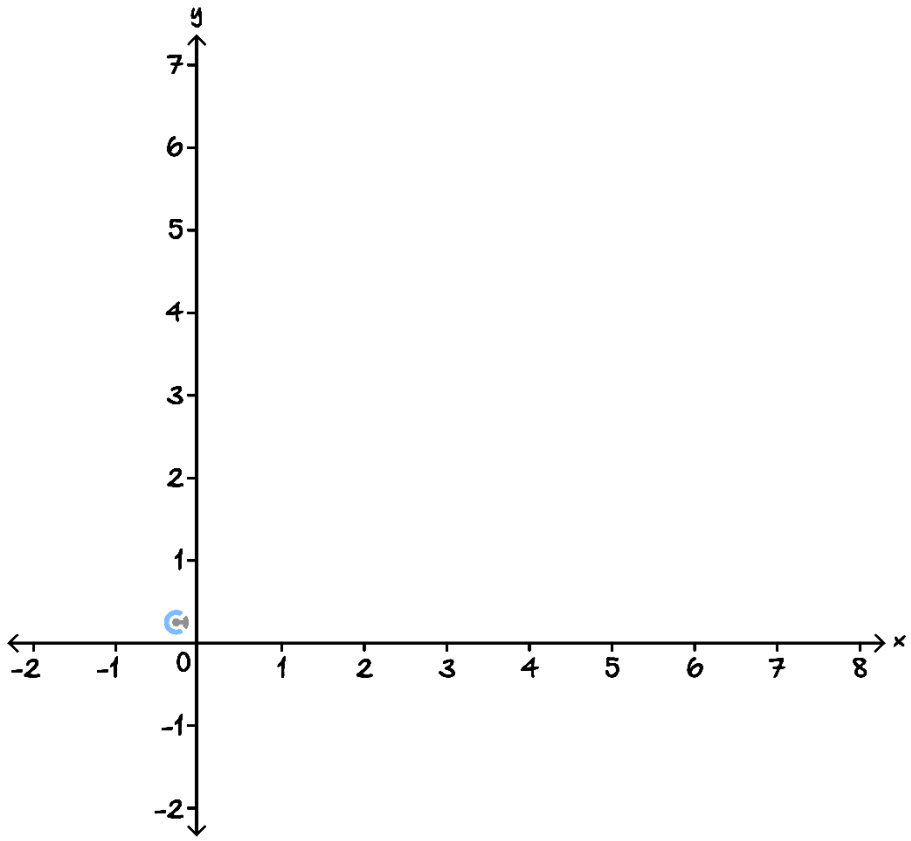
Consider the function $f: [a, \infty) \to \mathbb{R}, f(x) = x^2 - 6x + 10$.

a. Write $f(x)$ in turning point by completing the square.

b. Hence, state the smallest value of a such that, the inverse function f^{-1} exists.

c. Use functional notation to define f^{-1}.

d. Sketch the graphs of f and f^{-1} on the axes below. Label endpoints and any points of intersection with coordinates.



e. Let g be a one-to-one function with the same rule as f but a different domain. g is defined as:

$$g : (k, \infty) \to \mathbb{R}, g(x) = x^2 - 6x + 10.$$

Find the smallest value of k such that, g and g^{-1} do not intersect each other.

Section B: Supplementary Questions

Sub-Section [2.2.1]: Find Domain and Range of Functions

Question 14

Find the domain of the following functions:

a. $y = \sqrt{5 - 2x}$.

b. $y = -\frac{3}{x^2+4x-12}$.

c. $y = 2\log_e(x + 1)$.

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Question 15

Find the maximal domain of the following functions:

a. $y = \frac{\left(\sqrt{x^2+9x+18}\right)}{2}$.

b. $y = \frac{3}{\sqrt{6-5x-x^2}} - 4$

c. $y = \log_5\left((1-x)(x+4)^2\right) + 1$.

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Question 16

Express $f(x)$ in full function mapping notation:

a. $f(x) = \log_2(2x^2 + 7x + 6)$.

b. $f(x) = (3x^2 - 12x + 16)^{\frac{3}{2}}$.

c. $f(x) = 3\sqrt{-\frac{1}{4-2x} + 1}$.

Question 17

Find the maximal domain of the function $f(x) = x^2 + 4x + 12$ such that, the range of $f(x)$ is $[8,17)$.

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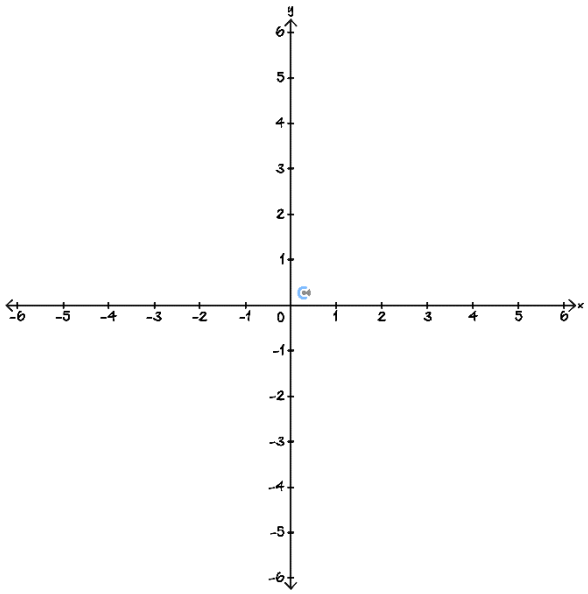
Sub-Section [2.2.2]: Sketch and Find the Domain and Range of Hybrid Functions

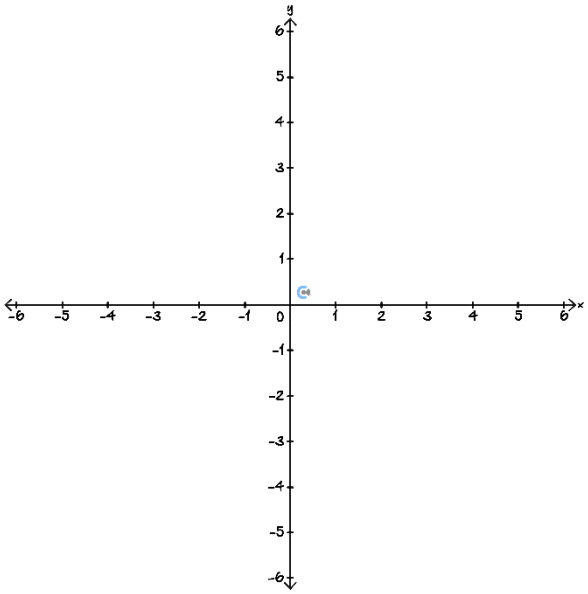
Question 18

Sketch the following graphs. Label all intercepts and endpoints.

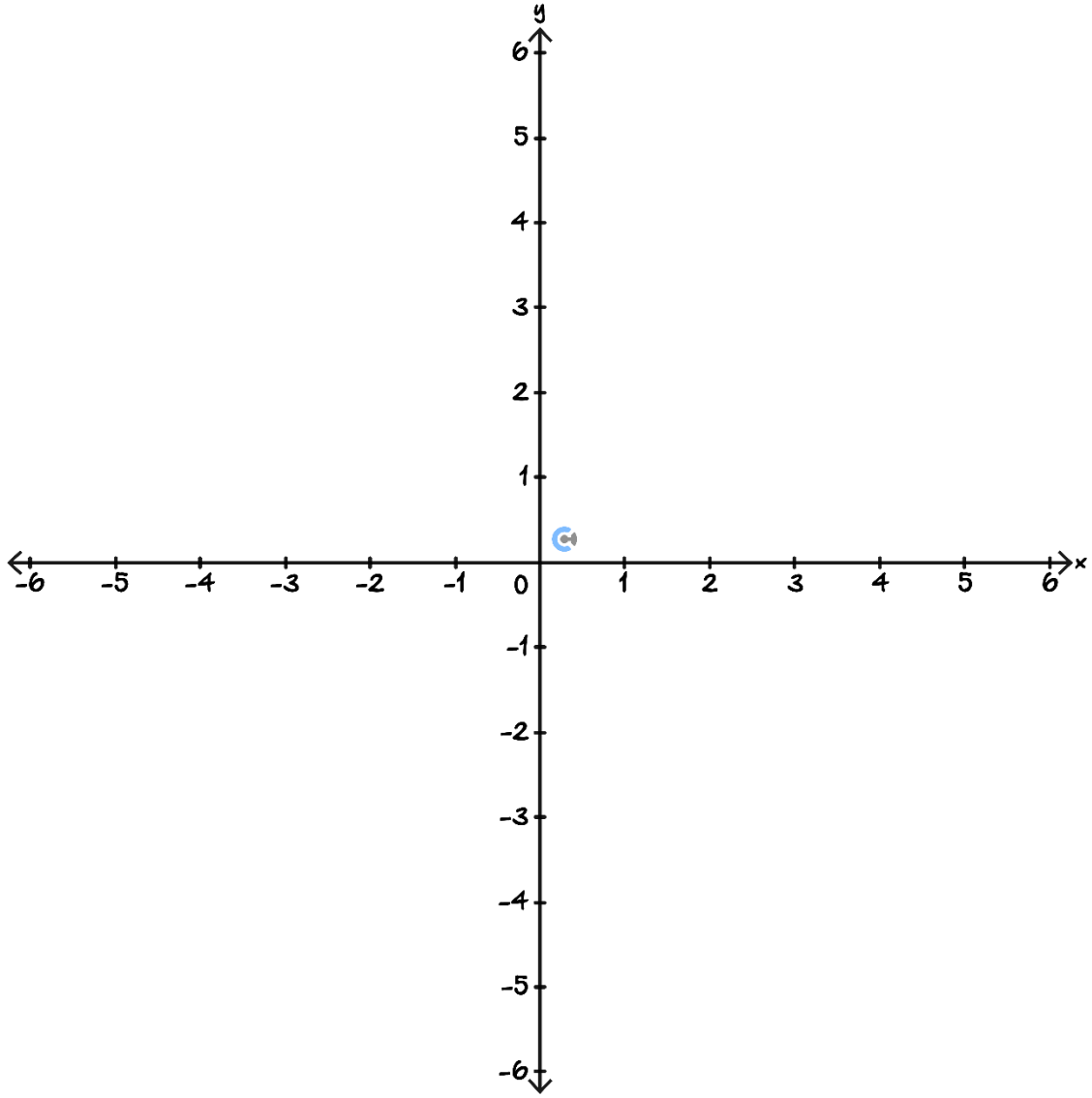
a. $f(x) = \begin{cases} \frac{1}{3}(x-2)^2 - 3, & 2 \leq x < 6 \\ -x - 1, & -1 < x < 2 \end{cases}$



b. $f(x) = \begin{cases} 2x + 4, & -3 < x \leq -2 \\ x^2 - x - 2, & -2 < x < 2 \end{cases}$



c. $f(x) = \begin{cases} 4 - x^2, & x \leq 0 \\ \frac{2}{x} - 1, & x \geq 1 \end{cases}$



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Question 19

Find the range of the following piecewise functions.

a. $f(x) = \begin{cases} x - 2, & -4 \leq x < 1 \\ 2x - 2, & 1 \leq x \leq 3 \end{cases}$

b. $f(x) = \begin{cases} x^2 - 4x + 6, & 0 < x < 5 \\ \frac{1}{2}x + 6, & -6 < x < 0 \end{cases}$

c. $f(x) = \begin{cases} x+4, & -3 < x < -1 \\ x^2, & -1 \leq x \leq 2 \\ x-4, & 2 < x < 8 \end{cases}$

Question 20

Find the maximal domain of the function $f(x) = \begin{cases} \sqrt{8-2x} \\ \log_e(-x^2+5x+6) \end{cases}$.

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Sub-Section [2.2.3]: Find the Rule, Domain, Range, and Intersections Between Inverse Functions

Question 21

The function $f(x)$ is defined as $f: [-5,1) \to \mathbb{R}, f(x) = \frac{2}{3-x} + 6$.

a. Find the equation of $f^{-1}(x)$.

b. Determine the domain of $f^{-1}(x)$.

c. State the range of $f^{-1}(x)$.

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Question 22

Consider the function $g: (-\infty, 0] \to \mathbb{R}, g(x) = 2x^2 - 12x + 16$.

a. Find the equation of the inverse function.

b. Find the domain of the inverse function.

c. State the range of the inverse function.

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Question 23

Consider the function $f(x) = 1 - \sqrt{7 - x}$.

a. Define the inverse function of $f(x)$, using full function mapping notation.

b. Find the point of intersection between $f(x)$ and $f^{-1}(x)$.

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Question 24

Find the values of k such that, the graph $f: [0, \infty) \to \mathbb{R}, f(x) = x^2 + k$ and $f^{-1}(x)$ have 2 solutions.

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