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VCE Mathematical Methods ½
Functions & Relations II [2.2]
Test Solutions

24 Marks. 29 Minutes Writing.

Results:

Test Questions	_____ / 24
Extension Questions	_____ / 3

Section A: Test Questions (24 Marks)

Question 1 (4 marks)

Tick whether the following statements are **True** or **False**.

Statement	True	False
a. A function's domain will always be its maximal domain. It can a subset of that.		✓
b. The expression inside a square root can only be positive. It can be 0 as well.		✓
c. All hybrid functions must "join together", i.e., be continuous.		✓
d. $f: D \to R, f(x) = x^2 + 4$ has a range of R.		✓
e. A function and its inverse are always symmetrical around $y = x$.	✓	
f. A relation needs to be one to one, for it to have an inverse relation.		✓
g. A function needs to be one to one, for it to have an inverse function.	✓	
h. Instead of equating $f(x)$ with its inverse to find the intersection between $f(x)$ and $f^{-1}(x)$, we can equate $f(x)$ to $y = x$ most of the time.	✓	

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Question 2 (4 marks)

State the implied domain and range for each of the relations below.

a. $y = 1 - \sqrt{1 - x}$. (2 marks)

$x \leq 1, y \leq 1$

b. $y = \sqrt{x^2 + 2x + 1}$. (2 marks)

$x \in R, y \geq 0$

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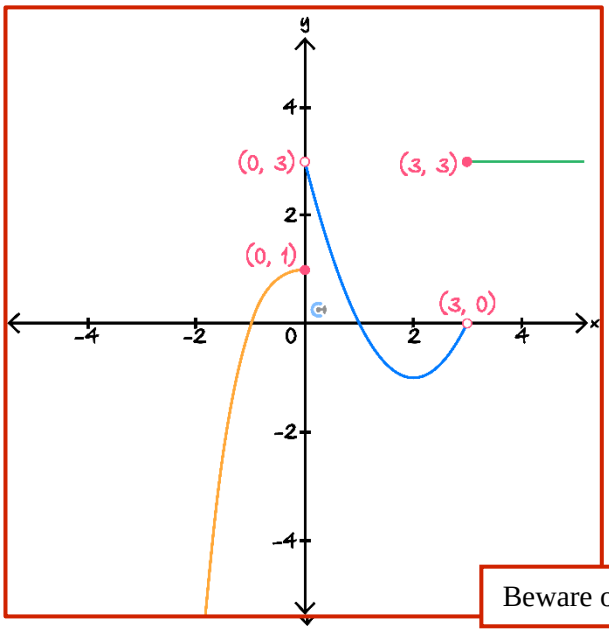
Question 3 (6 marks)

A function $g(x)$ is defined as,

$$g(x) = \begin{cases} x^3 + 1, & x \leq 0 \\ (x-2)^2 - 1, & 0 < x < 3 \\ 3, & x \geq 3 \end{cases}$$

a. Draw the graph of $y = g(x)$ on the axes below. (3 marks)



Beware of closed and open circles.

b. State the number of solutions to $g(x) = -\frac{1}{2}$. (1 mark)

3

c. State the range of $g(x)$. (1 mark)

Range g: $(-\infty, 3]$.

d. Solve the equation $g(x) = 3$. (1 mark)

$x \geq 3$
NOTE: $x \neq 0$

Question 4 (10 marks)

Consider the function $f: [0, a] \to R, f(x) = -(x-2)^2 + 4$.

a. Find the largest value of a such that the inverse function f^{-1} exists. (1 mark)

$a = 2$

b. State the domain and range of the inverse of f. (2 marks)

Domain: $(f^{-1}) = [0,4]$
Range: $(f^{-1}) = [0,2]$

c. Determine the equation of the inverse function f^{-1}. (3 marks)

1 mark: Swapping x and y for inverse
1 mark: Finding the equation with $+$
1 mark: Justifying the rejection

```
f[x_] := -(x - 2)^2 + 4

Solve[f[y] == x, y]
```

풀이 함수

$$\{\{y \to 2 - \sqrt{4 - x}\}, \{y \to 2 + \sqrt{4 - x}\}\}$$

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(* Reject 2+ because the range if [0,2] (less than equal to 2)*)
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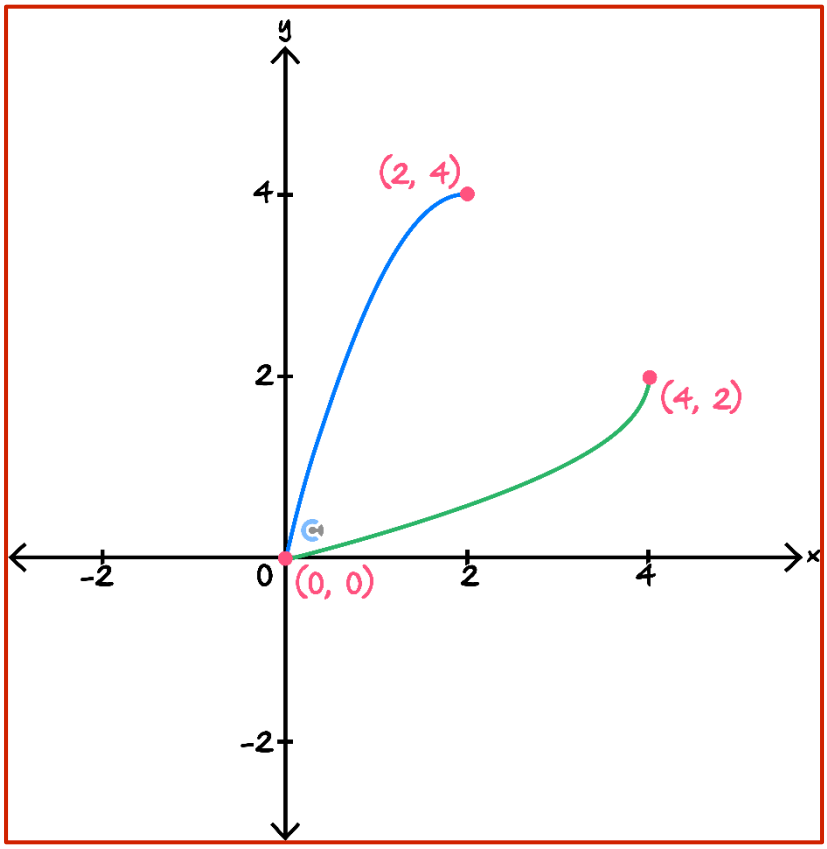
d. The graph of f is shown on the graph below. On the same set of axes, sketch accurately the graph of the inverse of f. (3 marks)



e. Find an intersection point between f and f^{-1}. (1 mark)

(0,0)

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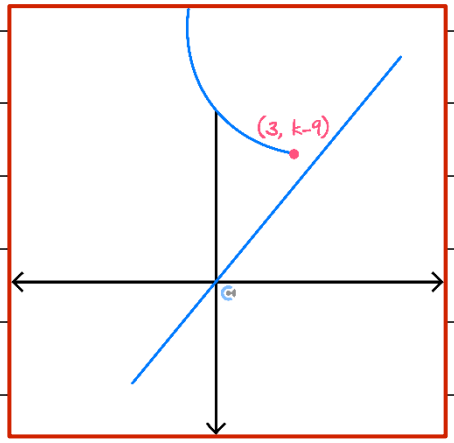
Section B: Extension Questions (3 Marks)

Question 5 (3 marks)

Consider the function below.

$$f: [0,3] \to R, f(x) = x^2 - 6x + k, \text{ where } k > 0$$

Find the value(s) of k such that f and f^{-1} never intersect.



1 mark for finding the turning point
1 mark for $k - 9 > 3$
1 mark for $k > 12$

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