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VCE Mathematical Methods ¾
Transformations [1.3]
Test Solutions

Results:

Test	_____ / 13.5
Extension	_____ / 6

Section A: Test Questions (13.5 Marks)

INSTRUCTION: 13.5 Marks. 17 Minutes Writing.

Question 1 (2.5 marks)

Tick whether the following statements are **true** or **false**.

	True	False
a. The image of a transformation is the point before the transformation is applied.		✓
b. When a point undergoes a dilation by a factor 3 from the y-axis, we can describe it as $x' = \frac{1}{3}x$.		✓
c. The transformation $x' = -2(x-2)$, indicates a translation of 2 units left, a dilation by a factor 2 from the y-axis and a reflection in the y-axis.	✓	
d. $y' = 2y + 1$ and $y' = 2\left(y + \frac{1}{2}\right)$ result in the same transformed function.	✓	
e. The transformation that maps $y = x^2$ to $y = 8x^2$ can be interpreted using either a dilation from the x-axis or the y-axis.	✓	

Space for Personal Notes

Question 2 (2 marks)

The series of transformations given by "a dilation by a factor of 5 from the x-axis, reflection in the x-axis, and a translation of 2 units up" yields the same result as the series of transformations given by "a translation by a units down, a reflection in the x-axis, and a dilation by a factor of b from the x-axis." Find the values of a and b.

$A=\frac{2}{5}$ and $b=5$

Question 3 (3 marks)

For the function $f: [0, \infty) \to R, f(x) = \sqrt{x+3}$, the function f is dilated by a factor of $\frac{3}{2}$ from the x-axis, translated 3 units in the negative x-direction, and then reflected in the y-axis to produce the function g.

Find the rule for $g(x)$ and state its domain.

$x' = -(x-3)$

$x = -x' + 3$

$y = \sqrt{x+3}$

$y = \sqrt{-x'+3+3}$

$y = \frac{3}{2}\sqrt{-x'+6}$

Original Domain: $[0, \infty)$

$\downarrow$

$[0, \infty)$

$\downarrow$

$[-3, \infty)$

$\downarrow$

$(-\infty, 3]$

Question 4 (3 marks)

Consider the following functions:

$$f(x) = \log_e(x + 4)$$

$$g(x) = 2\log_e(3x - 1) + 1$$

Find the series of transformations that map $f(x)$ to $g(x)$.

Dilation by factor 2 from x
Dilation by factor 1/3 from y
Translation 1 up
Translation 5/3 right.

Question 5 (3 marks)

The graph of a linear function $y = f(x)$ has an x-intercept at $(2, 0)$ and a y-intercept at $(0, -6)$. Find the x and y-intercepts of the graph of $y = 2f(3x)$.

Solution: The graph of $y = f(x)$ has undergone a transformation of

- A dilation by factor 2 from the x-axis
- A dilation by factor $\frac{1}{3}$ from the y-axis.

Therefore new x-intercept is $\left(\frac{2}{3}, 0\right)$ and new y-intercept is $(0, -12)$.

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Section B: Extension Test Questions (6 Marks)

INSTRUCTION: 6 Marks. 6 Minutes Writing.

Question 6 (3 marks)

It is known that $f(x)$ has a tangent $y = 2x + 3$ at $x = 3$. $f(x)$ has been transformed into $g(x)$, where $g(x) = 3f(2x - 1) + 2$.

Find the tangent of $g(x)$ at $x = 2$.

```
f[x_] := 2 x + 3

3 * f[2 x - 1] + 2 // Expand
                    확장

5 + 12 x
```

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Question 7 (3 marks)

Find a sequence of transformations that map the function $f(x) = x^2 - 6x + 13$ to the function $g(x) = 18(x-1)^2 + 10$.

Solution: $f(x) = (x-3)^2 + 4$. Let $y = f(x)$ and $y' = g(x)$ then

$$y - 4 = \frac{y' - 10}{18} \implies y' = 18y - 62$$

and

$$x - 3 = x' - 1 \implies x' = x - 2$$

Therefore,

- A dilation by factor 18 from the x-axis
- A translation 2 units to the left
- A translation 62 units down.

A different possible sequence is

- A dilation by factor 2 from the x-axis
- A dilation by factor $\frac{1}{3}$ from the y-axis
- A translation 2 units up.

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