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VCE Mathematical Methods ½
Transformations [2.4]
Test

15 Marks. 19 Minutes Writing.

Results:

Test	_____ / 15

Section A: Test Questions (15 Marks)

Question 1 (3 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. Reflection in the x-axis makes the y value negative of what it was.	✓	
c. When a point undergoes a dilation by a factor 3 from the y-axis, we can describe it as $x' = 3x$.	✓	
d. The transformation $x' = 2(x - 2)$, indicates a translation of 2 units left, and a dilation by a factor 2 from the x-axis.		✓
e. $y' = 2y + 1$ and $y' = 2\left(y + \frac{1}{2}\right)$ result in the same transformed function.	✓	
f. A transformation that maps $y = x^2$ to $y = 9x^2$ could be a dilation by factor 3 from the y-axis.		✓

Space for Personal Notes

Question 2 (2 marks)

$(x, 3y)$ $(x, 3y+8)$

The series of transformations given by "a dilation by a factor of 3 from the x-axis, followed by a translation of 8 units up", yields the exact same result as the series of transformations given by "a translation by a units up, followed by a dilation by a factor of b from the x-axis".

$(x, y+a)$

$(x, b(y+a))$

Find the values of a and b.

$3y+8 = b(y+a)$

$3\left(y+\frac{8}{3}\right) = b(y+a)$

$\therefore a = \frac{8}{3}, b = 3$

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Question 3 (3 marks)

Consider the following function: $f(x) = (x + 1)^2$
Apply the following transformations below to the function above.

Dilation by a factor of $\frac{1}{4}$ from the y-axis $\left(\frac{1}{4}x, y\right)$

Dilation by a factor of 2 from the x-axis $\left(\frac{1}{4}x, 2y\right)$

Translation by 2 units in the negative direction of the x-axis $\left(\frac{1}{4}x-2, 2y\right)$

Translation by 9 units in the positive direction of the y-axis $\left(\frac{1}{4}x-2, 2y+9\right)$

Reflection in the y-axis $\left(-\frac{1}{4}x+2, 2y+9\right)$

$\therefore x' = -\frac{1}{4}x + 2$ $\Rightarrow$ $x = -4(x'-2)$ $y = (x+1)^2$

$\therefore y' = 2y + 9$ $y = \frac{y'-9}{2}$ $\frac{y-9}{2} = (-4(x'-2)+1)^2$

$\therefore y = 2(-4x+9)^2 + 9$

$\therefore f(x) = 2(-4x+9)^2 + 9$

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Question 4 (3 marks)

Consider the following functions:

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

$$g(x) = -2\sqrt{7-2x} + 3$$

Find the set of transformations that maps $f(x)$ to $g(x)$.

$y = \sqrt{x+2} \Rightarrow y' = -2\sqrt{7-2x'} + 3$

$\frac{y'-3}{-2} = \sqrt{7-2x'}$

$y = \frac{y'-3}{-2}$

$x+2 = 7-2x'$

$2x' = 5-x$

$\therefore y' = -2y+3$

$x' = -\frac{1}{2}x + \frac{5}{2}$

1. Dil 2 from x
2. Reflection in x
3. 3 up

1. Dil $\frac{1}{2}$ from y
2. Reflection in y
3. $\frac{5}{2}$ right

Space for Personal Notes

Question 5 (2 marks)

Consider the following functions:

$$f_1(x) = x^3$$

$$f_2(x) = -2(3x+1)^3 - 1$$

Find the set of transformations that maps the function f_1 into f_2.

$y = x^3 \Rightarrow y' = -2(3x'+1)^3 - 1$

$y = \frac{y'+1}{-2}$ $\quad \frac{y'+1}{-2} = (3x'+1)^3$

$y' = -2y - 1$ $\quad x = 3x' + 1$

1. Dil 2 from x
2. Reflection in x
3. 1 down

$x' = \frac{x}{3} - \frac{1}{3}$

1. Dil $\frac{1}{3}$ from y
2. $\frac{1}{3}$ left

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Question 6 (3 marks)

$(x, \frac{5}{4}y)$

For the function $f(x) = \sqrt{x+2}$, the function f is dilated by a factor of $\frac{5}{4}$ from the x-axis, translated 2 units in the negative x-direction and then is reflected in the y-axis to produce the function g.

Find the rule for $g(x)$.

$(-(x-2), \frac{5}{4}y)$

$(x-2, \frac{5}{4}y)$

$\therefore x' = -x+2$

$\therefore y' = \frac{5}{4}y$

$x = 2-x'$

$y = \frac{4}{5}y'$

$y = \sqrt{x+2}$

$\frac{4}{5}y' = \sqrt{2-x'+2}$

$\therefore y = \frac{5}{4}\sqrt{4-x}$

$\therefore g(x) = \frac{5}{4}\sqrt{4-x}$

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