Composite, Inverse and Transformations: exam practice

10 questions · 34 marks · worked solutions and markschemes

Name _____ Date _____ Score / 34

- Answer every question before you look at the solutions. They start after the last question, with the marks for each line: M for method, A for accuracy, R for reasoning.
- Online, with more practice: ibmathrevision.com/hlai/composite-inverse-and-transformations-exam-practice

1. **4 marks · Paper 1 style · calculator allowed**

Find the inverse function $f^{-1}(x)$ for $f(x) = 3x + 2$.

2. **2 marks · Paper 1 style · calculator allowed**

The graph of $y = f(x)$ is transformed to $y = -2f(x + 3) + 1$.

Find the image of the point $(2, 5)$. **[2]**

3. **3 marks · Paper 1 style · calculator allowed**

The graph of $y = x^2 - 4$ is stretched horizontally by a factor of 2.

Find the equation of the new graph and its x-intercepts. **[3]**

4. **3 marks · Paper 2 style · calculator allowed**

The temperature in Celsius is $C = \frac{5}{9}(F - 32)$, where F is in Fahrenheit.

Find the inverse function and the temperature at which $C = F$. **[3]**

5. **4 marks · Paper 1 style · calculator allowed**

Let $f(x) = 3x - 5$ and $g(x) = \frac{x + 1}{2}$.

Find $(f \circ g)(x)$ and $f^{-1}(x)$. **[4]**

6. **5 marks · Paper 1 style · calculator allowed**

Find the inverse of the rational function $f(x) = \frac{2x-3}{x+1}$, where $x \neq -1$.

7. **3 marks · Paper 1 style · calculator allowed**

The graph of $y = f(x)$ has a local maximum point at $(3, 7)$. Find the coordinates of the local maximum point of the graph of $y = 2f\left(\frac{x}{3}\right)$.

8. **2 marks · Paper 1 style · calculator allowed**

The graph of $y = 3^x$ is translated by $\begin{pmatrix} 0 \\ -7 \end{pmatrix}$ to give the graph of $y = g(x)$.

a. Write down $g(x)$. **[1]**

b. Write down the equation of the horizontal asymptote of the graph of g. **[1]**

9. **4 marks · Paper 1 style · calculator allowed**

Let $f(x) = 2x - 5$ and $g(x) = x^2 + 1$.

(a) Find $(g \circ f)(x)$. **[2 marks]**

(b) Calculate $(f \circ g)(3)$. **[2 marks]**

10. **4 marks · Paper 1 style · calculator allowed**

The graph of $y = f(x)$ passes through the point $(2, 5)$. Write down the image of this point under each transformation.

a. $y = f(x) + 3$ **[1]**

b. $y = f(x - 4)$ **[1]**

c. $y = 2f(x)$ **[1]**

d. $y = f(-x)$ **[1]**

Answers and worked solutions

Question 1

4 marks

Answer:

$f^(-1)(x) = (x-2)/3$

Let $y = 3x + 2$ and swap x and y: $x = 3y + 2$. **M1**

Subtract 2: $3y = x - 2$. **A1**

Divide by 3: $y = \frac{x-2}{3}$. **M1**

$f^{-1}(x) = \frac{x-2}{3}$. **A1**

Question 2

2 marks

Answer: $(-1, -9)$

x: $2 - 3 = -1$ **A1**

y: $-2(5) + 1 = -9$ **A1**

Question 3

3 marks

Answer: $y = \frac{x^2}{4} - 4$; $x = \pm 4$

$y = \left(\frac{x}{2}\right)^2 - 4$ **A1**

$y = \frac{x^2}{4} - 4$ **A1**

$x = \pm 4$ **A1**

Question 4

3 marks

Answer: $F = \frac{9}{5}C + 32$; -40

$F = \frac{9}{5}C + 32$ **A1**

$C = \frac{5}{9}(C - 32)$ **M1**

-40 **A1**

Question 5

4 marks

Answer: $\frac{3x-7}{2}$; $\frac{x+5}{3}$

$3 \cdot \frac{x+1}{2} - 5$ **M1**

$\frac{3x-7}{2}$ **A1**

$f^{-1}(x) = \frac{x+5}{3}$ **A2**

Question 6

5 marks

Answer:

$f^(-1)(x) = (x+3)/(2-x)$

Let $x = \frac{2y-3}{y+1}$. **[M1]**

$x(y+1) = 2y - 3 \implies xy + x = 2y - 3$. **[M1]**

$xy - 2y = -x - 3 \implies y(x-2) = -x - 3$. **[M1]**

$f^{-1}(x) = \frac{-x-3}{x-2}$ or $\frac{x+3}{2-x}$. **[A1][A1]**

Question 7

3 marks

Answer: $(9, 14)$

horizontal stretch scale factor 3: $x = 9$ **(M1)**

vertical stretch scale factor 2: $y = 14$ **(M1)**

$(9, 14)$ **A1**

Question 8

2 marks

Answer: (a) $g(x) = 3^x - 7$; (b) $y = -7$

a. $g(x) = 3^x - 7$ **A1**

b. $y = -7$ **A1**

Question 9

4 marks

Answer: (a) $4x^2 - 20x + 26$; (b) 15

(a)

$(g \circ f)(x) = g(2x-5) = (2x-5)^2 + 1 = 4x^2 - 20x + 26$. **[M1][A1]**

(b) $g(3) = 3^2 + 1 = 10$. Then $f(10) = 2(10) - 5 = 15$. **[M1]** **[A1]**

Question 10

4 marks

Answer: (a) $(2, 8)$; (b) $(6, 5)$; (c) $(2, 10)$; (d) $(-2, 5)$

a. $(2, 8)$ **A1**

b. $(6, 5)$ **A1**

c. $(2, 10)$ **A1**

d. $(-2, 5)$ **A1**

Every solution is also on ibmathrevision.com/hlai/composite-inverse-and-transformations-exam-practice
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