

QT Compound & Inverse Functions



1. Given that $f(x) = x + 9$

(a) Find $f(6)$

(1 mark)

(b) Find $f(-2)$

(1 mark)

(c) Solve $f(x) = 12$

(2 marks)

$$\begin{aligned} \text{(a)} \quad f(6) &= 6 + 9 \\ &= \underline{\underline{15}}. \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad f(-2) &= -2 + 9 \\ &= \underline{\underline{7}}. \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad x + 9 &= 12 \\ x &= \underline{\underline{3}}. \end{aligned}$$

2. Given that $f(x) = 3x + 2$

(a) Find $f(3)$

(1 mark)

(b) Find $f(-4)$

(1 mark)

(c) Solve $f(x) = 14$

(2 marks)

$$\begin{aligned} \text{(a)} \quad f(3) &= 3(3) + 2 \\ &= 9 + 2 \\ &= \underline{\underline{11}}. \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad f(-4) &= 3(-4) + 2 \\ &= -12 + 2 \\ &= \underline{\underline{-10}} \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad 3x + 2 &= 14 \\ 3x &= 12 \\ x &= \underline{\underline{4}}. \end{aligned}$$

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3. Given that $f(x) = 3x^2 + 4$

(a) Find $f(3)$

(2 marks)

(b) Find $f(-3)$

(2 marks)

(c) Solve $f(x) = 16$

(2 marks)

$$\begin{aligned} \text{(a)} \quad f(3) &= 3(3)^2 + 4 \\ &= 3(9) + 4 \\ &= \underline{\underline{31}}. \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad f(-3) &= 3(-3)^2 + 4 \\ &= 3(9) + 4 \\ &= \underline{\underline{31}}. \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad 3x^2 + 4 &= 16 \\ 3x^2 &= 12 \\ x^2 &= 4 \\ x &= \underline{\underline{\pm 2}}. \end{aligned}$$

4. Given that $g(x) = x^2 + 5$

(a) Find $g(8)$

(1 mark)

(b) Find $g(-6)$

(1 mark)

(c) Work out the expression for $g^{-1}(x)$

(2 marks)

(d) Find $g^{-1}(x) = 4$

(2 marks)

$$\begin{aligned} \text{(a)} \quad g(8) &= 8^2 + 5 \\ &= \underline{\underline{69}}. \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad g(-6) &= (-6)^2 + 5 \\ &= \underline{\underline{41}}. \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad y &= x^2 + 5 \\ y - 5 &= x^2 \\ \sqrt{y - 5} &= x \\ g^{-1}(x) &= \underline{\underline{\sqrt{x - 5}}} \end{aligned}$$

$$\begin{aligned} \text{(d)} \quad g^{-1}(x) &= 4 \\ \sqrt{x - 5} &= 4 \\ x - 5 &= 16 \\ x &= \underline{\underline{21}}. \end{aligned}$$

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5. Given that $f(x) = 3x + 2$ and $g(x) = 2x - 6$

(a) Find $gf(3)$

(2 marks)

(b) Solve $f(x) = g(x)$

(2 marks)

$$(a) f(3) = 3(3) + 2 \\ = 11$$

$$gf(3) = 2(11) - 6 \\ = \underline{\underline{16}}$$

$$(b) 3x + 2 = 2x - 6 \\ x + 2 = -6 \\ x = \underline{\underline{-8}}$$

6. Given that $f(x) = 2x - 2$ and $g(x) = x + 3$

(a) Work out the expression for $f^{-1}(x)$

(2 marks)

(b) Work out the expression for $g^{-1}(x)$

(2 marks)

(c) Solve $f^{-1}(x) = g^{-1}(x)$

(2 marks)

$$(a) y = 2x - 2 \\ y + 2 = 2x \\ \frac{y+2}{2} = x \\ f^{-1}(x) = \underline{\underline{\frac{x+2}{2}}}$$

$$(b) y = x + 3 \\ y - 3 = x \\ g^{-1}(x) = \underline{\underline{x - 3}}$$

$$(c) \frac{x+2}{2} = x-3 \\ x+2 = 2(x-3) \\ x+2 = 2x-6 \\ 2 = x-6 \\ 8 = x \\ \therefore x = \underline{\underline{8}}$$

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7. Given the function $f(x) = -5 - 9x$, find the value of $f^{-1}f(8)$ (3 marks)

$$f(8) = -5 - 9(8)$$

$$= \underline{\underline{-77}}$$

$$f^{-1}f(8) = \frac{-77 + 5}{-9}$$

$$= \underline{\underline{8}}$$

$$y = -5 - 9x$$

$$\frac{y+5}{-9} = x$$

$$\therefore f^{-1}(x) = \frac{x+5}{-9}$$

8. A function f is defined such that $f(x) = \frac{x}{x-2}$

(a) Find the value of $f(\frac{5}{2})$

(2 marks)

(b) Find $f^{-1}(x)$

$$(a) f(x) = \frac{\frac{5}{2}}{\frac{5}{2} - 2}$$

$$= \frac{\frac{5}{2}}{\frac{5}{2} - \frac{4}{2}}$$

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

$$= \underline{\underline{5}}$$

$$(b) y = \frac{x}{x-2}$$

$$y(x-2) = x$$

$$xy - 2y = x$$

$$xy - x = 2y$$

$$x(y-1) = 2y$$

$$x = \frac{2y}{y-1}$$

$$f^{-1}(x) = \underline{\underline{\frac{2x}{x-1}}}$$