



Functions and composite functions

About 50 minutes Calculator allowed 43 marks

Date _____

A Do Now

The first question is what today's lesson needs. The others bring back earlier topics.

- A1** Needed today [2 marks] **A2** From chapter 22 [2 marks]
- $P = 7a - 4b$. Find b when $P = 37$ and $a = 3$.
- Given that $\cos 48^\circ = 0.669$, solve $\cos x = -0.669$ for $0^\circ \leq x \leq 360^\circ$.

Answer

Answer

- A3** From chapter 8 [2 marks] **A4** From chapter 9 [2 marks]
- Expand and simplify $(x - 4)(x + 4)(x + 4)$.
- A sector has angle 300° and radius 3 cm. Find its perimeter, in terms of π .

Answer

Answer

B Example, then your turn

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

$f(x) = 3x - 2$ and $g(x) = x^2 + 1$. Work out $fg(2)$ and $gf(2)$, then write $fg(x)$ in terms of x .

Hint $fg(2)$ means do g first, then f . The function nearest the bracket goes first.

- B1** $f(x) = 2x + 5$ and $g(x) = x^2 - 6$. Work out $gf(-1)$, then write $fg(x)$ in terms of x . [3 marks]

Answer $gf(-1) = \dots\dots$ $fg(x) = \dots\dots\dots$

EXAMPLE 2

$f(x) = \frac{2x+9}{5}$. Find $f^{-1}(x)$.

Hint Write $y = f(x)$, make x the subject, then swap x and y back.

- B2** $g(x) = 7 - 2x$. Find $g^{-1}(x)$, then work out $g^{-1}(-5)$. [3 marks]

Answer $g^{-1}(x) = \dots\dots\dots$ $g^{-1}(-5) = \dots\dots$

C Practice

- C1** $h(x) = x^2 + 4x$. Solve $h(x) = 21$. [2 marks] **C2** $f(x) = x^2 - 3x$. Write $f(x + 2)$ in its simplest form. [2 marks]

Answer

Answer

- C3** $f(x) = 4x - 3$. Find $ff(x)$ in its simplest form. [2 marks] **C4** $f(x) = \frac{5}{x-1} + 2$. Find $f^{-1}(x)$. [3 marks]

Answer

Answer

- C5** $f(x) = 2x - 1$ and $g(x) = x^2 + 3$. [3 marks]
Solve $fg(x) = 37$. **C6** $f(x) = x^3 - 5$. Work out $f^{-1}(59)$. [2 marks]

Answer

Answer

D Exam-style questions

- D1** $f(x) = 2x + 6$. Lena says, " $f^{-1}(4) = \frac{1}{f(4)} = \frac{1}{14}$." [2 marks]

Explain why Lena is wrong, and work out the correct value of $f^{-1}(4)$.

- D2** A bank changes pounds into euros. It uses $e(x) = 1.15x$ to change x pounds into euros. It then takes a fee of 4 euros, using $h(x) = x - 4$.

- (a) Work out $he(200)$, the number of euros paid out for £200. [1 mark]

Answer €

- (b) Find $(he)^{-1}(x)$. [2 marks]

Answer

- (c) Kim is paid €341. Work out how many pounds she changed. [2 marks]

Answer £

Total for D2: 5 marks

- D3** $f(x) = ax + b$, where a and b are numbers. $f(2) = 11$ and $f^{-1}(26) = 7$. Work out the values of a and b . [4 marks]

Answer $a = \dots\dots$ $b = \dots\dots$

E Extension

No route is given. The hints are at the end of the sheet. Use one at a time.

- E1** $f(x) = 3x + k$ and $g(x) = x^2$, where k is a non-zero number. The equation $gf(x) = fg(x)$ has exactly one solution. Work out the value of k . [4 marks]

Answer $k = \dots\dots$

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** Write $gf(x)$ and $fg(x)$ out in full and set them equal.
Hint 2 $(3x + k)^2 = 3x^2 + k$ gives $6x^2 + 6kx + k^2 - k = 0$.
Hint 3 One solution means $b^2 - 4ac = 0$:
 $36k^2 - 24(k^2 - k) = 0$.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

- I can use function notation and solve $f(x) = k$. ☐ ☐ ☒
- I can work out composite functions like $fg(x)$, in the right order. ☐ ☐ ☒
- I can find and use an inverse function. ☐ ☐ ☒