

Examination Practice Questions

You should have:

A ruler, protractor, compasses, a pen, pencil, eraser, calculator.
For some questions, you may need tracing paper.

Instructions

- Use **black** ink or ball-point pen.
- Answer the questions in the spaces provided – *there may be more space than you need*.
- **Calculators may be used.**

Information

- The marks for each question are shown in brackets.
- Use the number of marks for each question as a guide as to how much time to spend on each question. As a rough guide, you can multiply the number of marks by 1.2 to see how many minutes you should spend on a question.
- Questions been carefully compiled from or modelled on a variety of past papers and will generally get more challenging as the document progresses. Some of the later questions will go beyond the core grade level for this topic.

Advice

- Read each question carefully before you start to answer it.
- Don't forget to have fun.
- Check your answers at the end.

Q1.

AtoZrevision.com

The function f is such that $f(x) = (x - 4)^2$ for all values of x .

The function g is such that $g(x) = \frac{4}{x+3}$ $x \neq -3$

Work out $fg(2)$.

$$\frac{4}{2+3} = \frac{4}{5}$$

m_1

$$\left(\frac{4}{5} - 4\right)^2 = 10.24$$

A_1

(2 marks)

Q2.

AtoZrevision.com

The functions f and g are defined as

$$f(x) = x^2 + 6$$

$$g(x) = x - 10$$

Find $fg(3)$

$$3 - 10 = -7$$

m_1

$$(-7)^2 + 6 = 55$$

A_1

(2 marks)

Q3.

AtoZrevision.com

The functions f and g are defined as

$$f: x \rightarrow 5x - 7$$

$$g: x \rightarrow \frac{5x}{x+4}$$

Find $gf(2.6)$

$$5(2.6) - 7 = 6$$

m_1

$$\frac{5(6)}{6+4} = 3$$

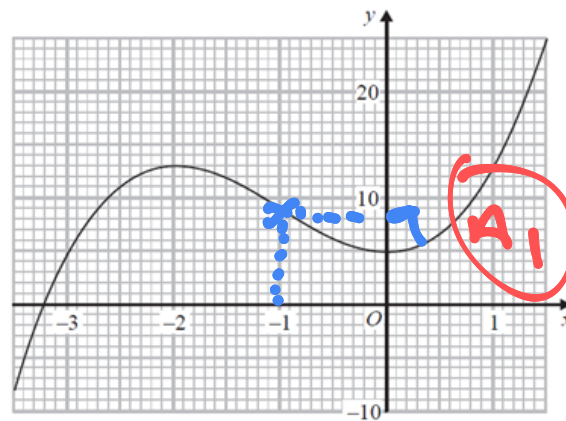
A_1

(2 marks)

Q4.

AtoZrevision.com

The diagram shows the graph of $y = f(x)$ for $-3.5 \leq x \leq 1.5$



$$g(x) = \frac{1}{2+x}$$

Find $fg(-3)$

$$\frac{1}{2-3} = \frac{1}{-1} = -1$$

m₁

9

(2 marks)

Q5.

AtoZrevision.com

$$f(x) = 5x^2 - 10x + 7 \text{ where } x \geq 1$$

$$g(x) = 7x - 6$$

Find $fg(2)$

$$7(2) - 6 = 8$$

m₁

$$5(8)^2 - 10(8) - 7 = 247$$

A₁

(2 marks)

The functions f and g are such that

$$f(x) = 2x - 3$$

$$g(x) = \frac{x}{3x+1}$$

Find $gf(x)$

Simplify your answer.

$$\frac{2x-3}{3(2x-3)+1} = \frac{2x-3}{6x-9+1}$$

M1

$$= \frac{2x-3}{6x-8}$$

A1

(2 marks)

The functions f and g are defined by $f(x) = x^2 + 1$ and $g(x) = 3x - 4$.

Find $g(f(x))$.

$$3(x^2+1)-4$$

M1

$$= 3x^2+3-4$$

$$= 3x^2-1$$

A1

$$3x^2-1$$

(2 marks)

Q8.

AtoZrevision.com

The functions f and g are defined as

$$f(x) = \frac{x}{4x-3} \text{ and } g(x) = x - 5$$

Find $fg(x)$.

Simplify your answer.

$$\begin{aligned} & \frac{x-5}{4(x-5)-3} = \frac{x-5}{4x-20-3} \\ & = \frac{x-5}{4x-23} \end{aligned}$$

m.

A1

(2 marks)

Q9.

AtoZrevision.com

The functions g and h are defined as

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

$$h(x) = x + 4$$

Find $gh(x)$

Simplify your answer.

$$\begin{aligned} & \frac{x+4}{2(x+4)-5} \\ & = \frac{x+4}{2x+8-5} \\ & = \frac{x+4}{2x+3} \end{aligned}$$

m.

A1

(2 marks)

Q10.

AtoZrevision.com

f is the function such that $f(x) = \frac{3x}{x-2}$ where $x \neq 2$

g is the function such that $g(x) = \frac{4x}{5}$

Express the composite function fg in the form $fg(x) = \dots$

Give your answer as a single fraction in its simplest form.

$$\begin{aligned}
 & \left[\begin{array}{l} \text{M}_1 \\ 3 \left(\frac{4x}{5} \right) \end{array} \right] = \frac{12x}{5} \div \frac{4x-10}{5} \\
 & \left(\frac{4x}{5} \right) - 2 = \frac{4x}{5} - \frac{10}{5} = \frac{4x-10}{5} \\
 & \frac{12x}{5} \times \frac{5}{4x-10} = \frac{60x}{20x-50} = \frac{6x}{2x-5} \quad (3 \text{ marks}) \\
 & \text{A}_1
 \end{aligned}$$

Q11.

AtoZrevision.com

$$f(x) = \frac{1-x}{1+x}$$

Find $ff(x)$.

$$\begin{aligned}
 & \left[1 - \left(\frac{1-x}{1+x} \right) \div 1 + \left(\frac{1-x}{1+x} \right) \right] \text{M}_1 \\
 & \frac{1+x - 1+x}{1+x} = \frac{2x}{1+x} \\
 & \frac{1-x}{1+x} + 1 = \frac{1-x+1+x}{1+x} = \frac{2}{1+x} \quad \text{A}_1 \\
 & \left[\frac{2x}{1+x} \div \frac{2}{1+x} \right] \text{M}_1 \\
 & = \frac{2x + 2x^2}{2 + 2x} = \frac{x+x^2}{1+x} = \frac{x(1+x)}{1+x} = x \quad (3 \text{ marks}) \\
 & \text{A}_1
 \end{aligned}$$

The functions f and g are defined as

$$f: x \rightarrow 5x - 7$$

$$g: x \rightarrow \frac{5x}{x+4}$$

$$\text{Solve } fg(x) = 2$$

$$5 \left(\frac{5x}{x+4} \right) - 7 = 2 \quad \text{M}_1$$

$$\frac{25x}{x+4} - 7 = 2$$

$$\frac{25x}{x+4} = 9 \quad \text{M}_1$$

$$25x = 9x + 36$$

$$16x = 36$$

$$x = \frac{36}{16}$$

$$= \frac{18}{8} = \frac{9}{4} \quad \text{A}_1$$

(3 marks)

f is the function such that $f(x) = 2x - 5$

g is the function such that $g(x) = x^2 - 10$

$$\text{Solve } gf(x) = -1$$

$$(2x - 5)^2 - 10 = -1$$

$$(2x - 5)^2 = 9 \quad \text{M}_1$$

$$2x - 5 = 3$$

$$x = 4 \quad \text{A}_1$$

$$2x - 5 = -3$$

$$x = 1 \quad \text{A}_1$$

(3 marks)

The functions f and g are defined as

$$f(x) = x^2 + 6$$

$$g(x) = x - 10$$

Solve the equation $fg(x) = f(x)$

$$\begin{aligned} (x-10)^2 + 6 &= x^2 + 6 & m_1 \\ x^2 - 20x + 100 + 6 &= x^2 + 6 & m_1 \\ x^2 - 20x + 106 &= x^2 + 6 \\ 100 &= 20x \\ 5 &= x & A_1 \end{aligned}$$

(3 marks)

For all values of x

$$f(x) = 2x - 3 \quad \text{and} \quad g(x) = x^2 + 2$$

Solve $fg(x) = gf(x)$

$$\begin{aligned} 2(x^2 + 2) - 3 &= (2x - 3)^2 + 2 & m_1 \\ 2x^2 + 4 - 3 &= 4x^2 - 12x + 9 + 2 + 1 \\ 2x^2 + 1 &= 4x^2 - 12x + 12 & m_1 \\ 2x^2 + 1 &= 4x^2 - 12x + 11 \\ 0 &= 2x^2 - 12x + 10 & m_1 \\ 0 &= x^2 - 6x + 5 \\ x=1 \quad x=5 & & A_1 \end{aligned}$$

(4 marks)

$$f(x) = \frac{2}{x}$$

$$g(x) = \frac{x+1}{x}$$

Solve $gf(a) = 3$

$$\frac{\left(\frac{2}{x}\right) + 1}{x} = 3 \quad \frac{2}{x} + 1 = 3x$$

$$-6 \quad \text{M1} \quad 2 + x = 3x^2$$

$$-1 \quad 3x^2 - x - 2 = 0$$

$$\text{M1} \quad 3x^2 - 3x + 2x - 2 = 0$$

$$3x(x-1) + 2(x-1) = 0$$

$$(3x+2)(x-1) = 0$$

$$x = 1 \quad x = -2/3$$

$$\text{A1} \quad (3 \text{ marks})$$

$$f(x) = x^2$$

$$g(x) = x - 3$$

Solve the equation $gf(x) = g^{-1}(x)$

$$x^2 - 3 = x + 3$$

$$x^2 - x - 6 = 0$$

$$(x-3)(x+2) = 0$$

$$x = 3 \quad x = -2$$

$$\text{A1}$$

$$y = x + 3$$

$$g^{-1} = x + 3$$

$$x = y - 3$$

(5 marks)