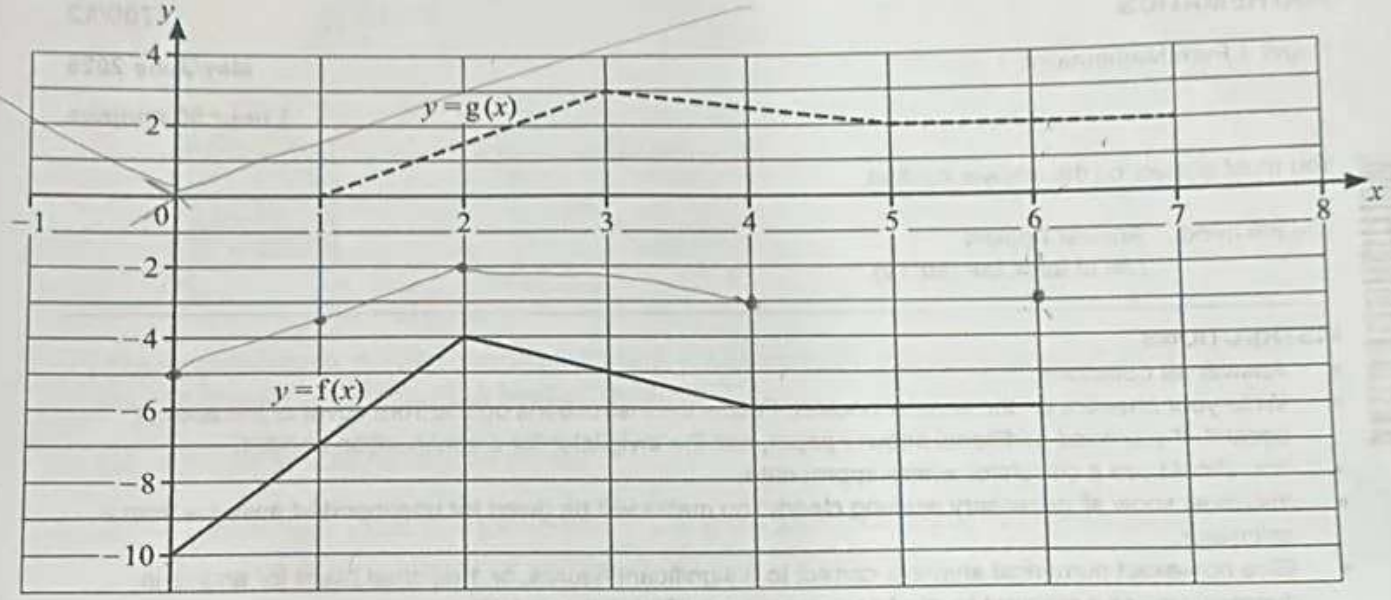
1 Solve the equation

$$3x^2 - 8 - \frac{16}{x^2} = 0.$$

[3]

2



In the diagram, the graph with equation $y = f(x)$ is shown with solid lines and the graph with equation $y = g(x)$ is shown with broken lines.

(a) Describe fully a sequence of transformations which transforms the graph of $y = f(x)$ to the graph of $y = g(x)$. You should make clear the order in which the transformations are applied. [5]

(b) Find an expression for $g(x)$ in the form $af(x+b)+c$, where a, b and c are constants. [2]

3 The perpendicular bisector of the line joining (4, 3) and (−2, 6) meets the line $x - 4y - 4 = 0$ at the point P.

Find the coordinates of P. [6]

4 **(a)** **(i)** Find the first three terms, in ascending powers of x, in the expansion of $\left(3 - \frac{1}{2}x\right)^4$. [2]

(ii) Find the first three terms, in ascending powers of x, in the expansion of $(2+ax)^3$. Give your answer in terms of the constant a. [1]

(b) It is now given that the coefficient of x^2 in the expansion of $\left(3 - \frac{1}{2}x\right)^4 (2+ax)^3$ is -108.

Find the value of a. [4]

5 The equation of a curve is such that $\frac{d^2y}{dx^2} = 6x^2 + p$, where p is a constant. The curve has minimum points at $(2, 3)$ and $(-2, 3)$.

Find the coordinates of the other stationary point of the curve. [7]

6 Solve the equation

$$\cos^{-1}\left(\sin^2 x + \tfrac{3}{2}\sin x\right) = \tfrac{2}{3}\pi$$

for $0 \leqslant x \leqslant 2\pi$. [4]

7 **(a)** The second, fourth and last terms of an arithmetic progression are 60, 52 and -28 respectively.

Find the sum of all of the terms in the progression. [4]

(b) The second, third and fourth terms of a geometric progression are 9, $k+4$ and k^2 respectively, where k is a negative constant.

(i) Find the value of k. [3]

(ii) Find the sum to infinity of the progression. [3]

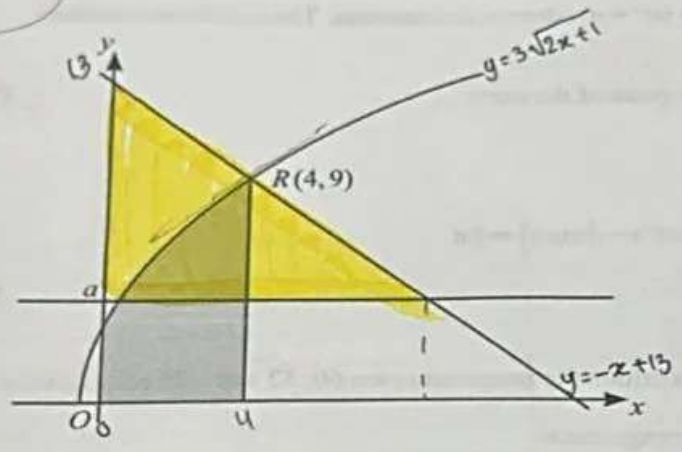
8 A diameter of a circle has end-points at $(-2, 4)$ and $(8, 8)$.

(a) Find an equation of the circle. [4]

(b) The line with equation $y = x + 6$ intersects the circle at the points P and Q.

Find the exact distance PQ. Give your answer in the form $a\sqrt{b}$, where a and b are both integers greater than 1. [7]

Questions 9 and 10 are on the back page.



The diagram shows the curve with equation $y = 3\sqrt{2x+1}$, the normal to the curve at the point $R(4, 9)$ and the line $y = a$, where a is a positive constant.

(a) Find the area of the shaded region. [4]

(b) Find the exact value of a for which the triangular area enclosed by the y-axis, the normal to the curve at R and the line $y = a$ is equal to the area found in **9(a)**. [7]

10 A function f is defined by

$$f(x) = px^2 - 2x + p + 4$$

for $x \in \mathbb{R}$, where p is a constant.

(a) Find the exact values of p for which the equation $f(x) = 0$ has repeated roots. [3]

A function g is defined by

$$g(x) = px^2 - 2x + p + 4$$

for $x \geqslant a$, where p and a are positive constants.

(b) (i) Show that the least value of a for which the function g^{-1} exists is $\frac{1}{p}$. [2]

(ii) Given that $p = 2$ and g^{-1} does exist, find an expression for $g^{-1}(x)$. [4]