GCSE Grade 8/9

Maths Booklet 4

Paper 1H
Non-Calculator

1 Here is a rectangle and a right-angled triangle.

$3x - 2$

$x - 1$

$2x$

x
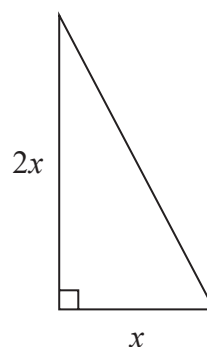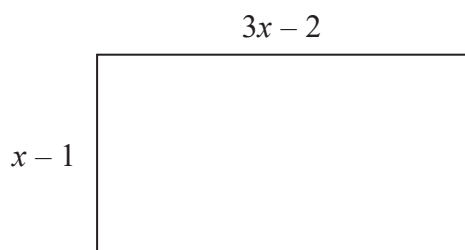
All measurements are in centimetres.
The area of the rectangle is greater than the area of the triangle.

Find the set of possible values of x.

....

(Total for Question 1 is 5 marks)

2 f and g are functions such that

$$f(x) = \frac{12}{\sqrt{x}} \quad \text{and} \quad g(x) = 3(2x + 1)$$

(a) Find g(5)

....
(1)

(b) Find gf(9)

....
(2)

(c) Find $g^{-1}(6)$

....
(2)

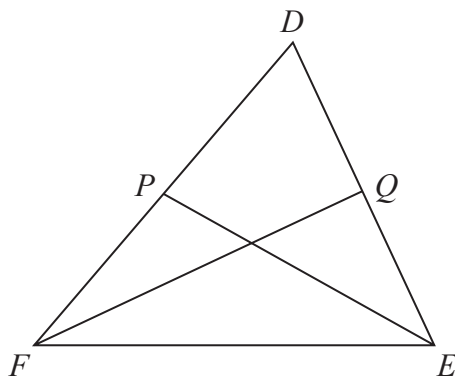**(Total for Question 2 is 5 marks)**

3 Show that $\dfrac{\sqrt{180} - 2\sqrt{5}}{5\sqrt{5} - 5}$ can be written in the form $a + \dfrac{\sqrt{5}}{b}$ where a and b are integers.

(Total for Question 3 is 4 marks)

Turn over ▶

4 *DEF* is a triangle.

P is the midpoint of *FD*.
Q is the midpoint of *DE*.

$\overrightarrow{FD} = \mathbf{a}$ and $\overrightarrow{FE} = \mathbf{b}$

Use a vector method to prove that *PQ* is parallel to *FE*.
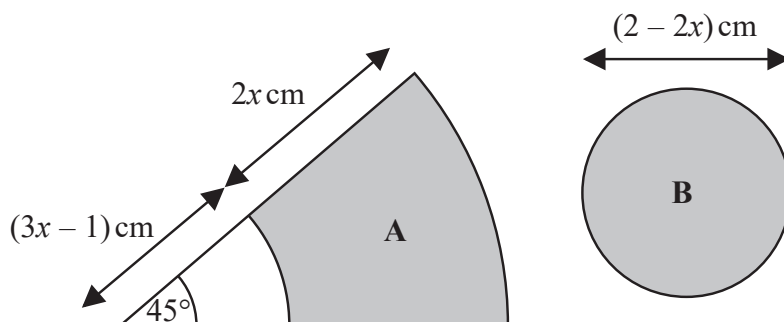
(Total for Question 4 is 4 marks)

5 The diagram shows two shaded shapes, **A** and **B**.

Shape **A** is formed by removing a sector of a circle with radius $(3x - 1)$ cm from a sector of the circle with radius $(5x - 1)$ cm.
Shape **B** is a circle of diameter $(2 - 2x)$ cm.

The area of shape **A** is equal to the area of shape **B**.

Find the value of x.
You must show all your working.

....

(Total for Question 5 is 5 marks)

6 There are four types of cards in a game.

Each card has a black circle or a white circle or a black triangle or a white triangle.

$$\boxed{\bullet} \quad \boxed{\bigcirc} \quad \boxed{\blacktriangle} \quad \boxed{\triangle}$$

number of cards with a black shape	:	number of cards with a white shape	=	$3:5$

number of cards with a circle	:	number of cards with a triangle	=	$2:7$

Express the total number of cards with a black shape as a fraction of the total number of cards with a triangle.

....

(Total for Question 6 is 3 marks)

7 Here is trapezium *ABCD*.
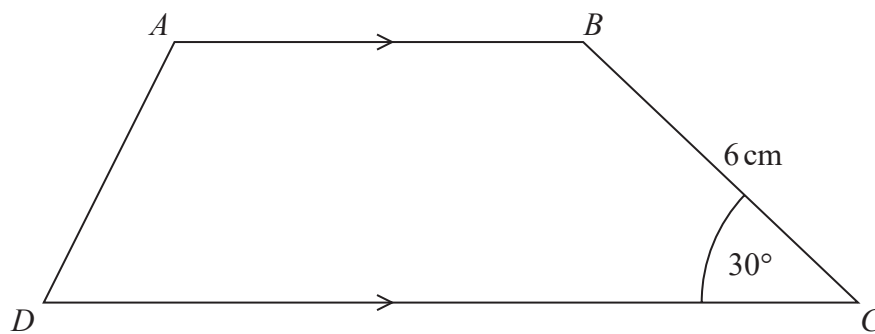
The area of the trapezium is $66\,\text{cm}^2$

   the length of *AB* : the length of *CD* = 2 : 3

Find the length of *AB*.

.... cm

(Total for Question 7 is 5 marks)

8 Show that $\dfrac{8 + \sqrt{12}}{5 + \sqrt{3}}$ can be written in the form $\dfrac{a + \sqrt{3}}{b}$, where a and b are integers.

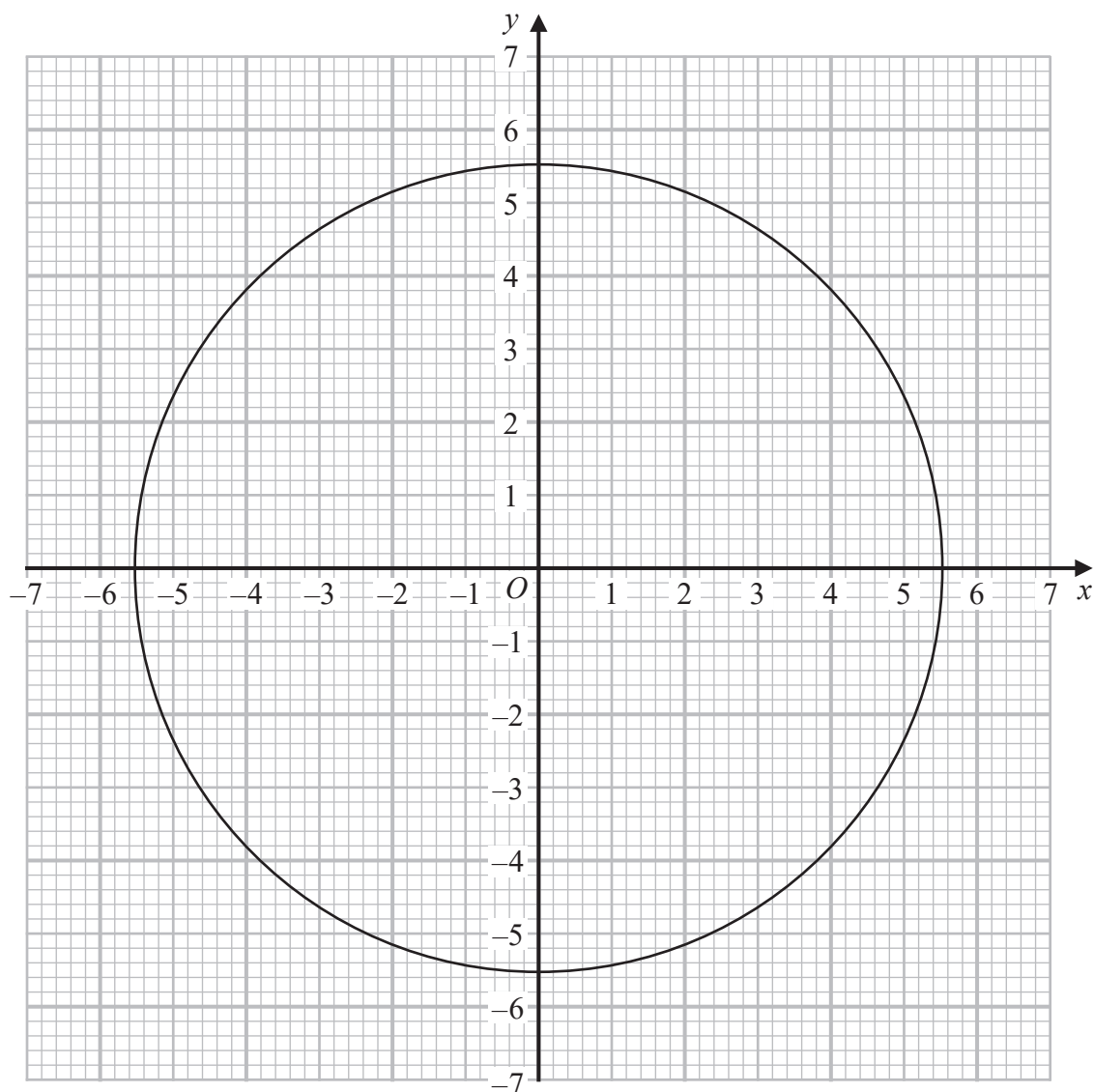**(Total for Question 8 is 4 marks)**

9 The diagram shows the graph of $x^2 + y^2 = 30.25$

Use the graph to find estimates for the solutions of the simultaneous equations

$$x^2 + y^2 = 30.25$$
$$y - 2x = 1$$

....

(Total for Question 9 is 3 marks)

10 The functions f and g are such that

$$f(x) = 3x^2 + 1 \quad \text{for } x > 0 \qquad \text{and} \qquad g(x) = \frac{4}{x^2} \quad \text{for } x > 0$$

(a) Work out gf(1)

....

(2)

The function h is such that $h = (fg)^{-1}$

(b) Find h(x)

....

(4)

(Total for Question 10 is 6 marks)