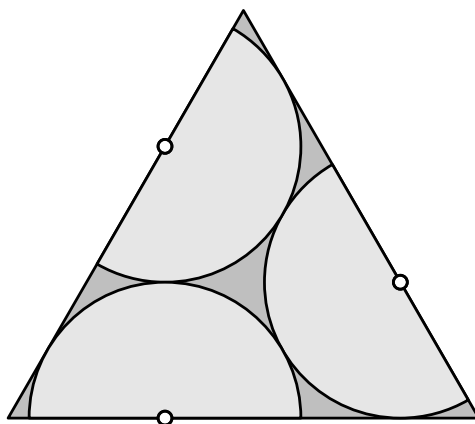# Mock Grade 8/9

Maths Booklet 3

Paper 1H
Non-Calculator

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1   The diagram shows three touching semicircles with radius 1 inside an equilateral triangle, which each semicircle also touches. The diameter of each semicircle lies along a side of the triangle.
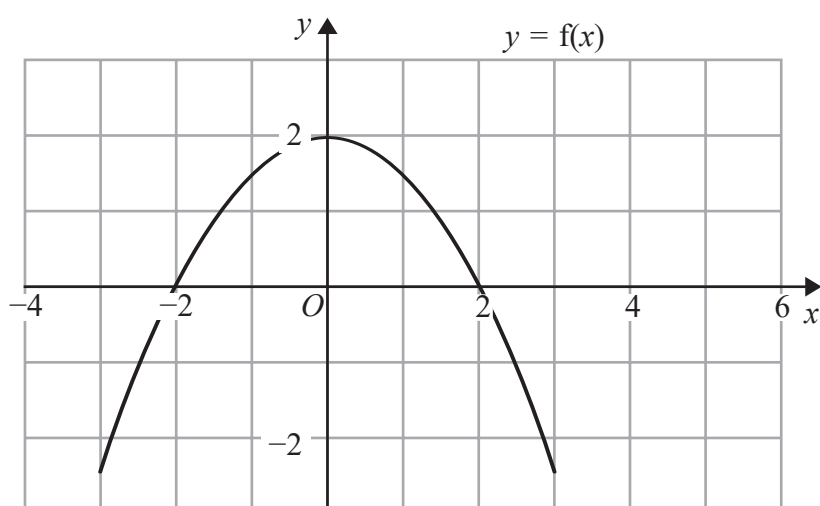
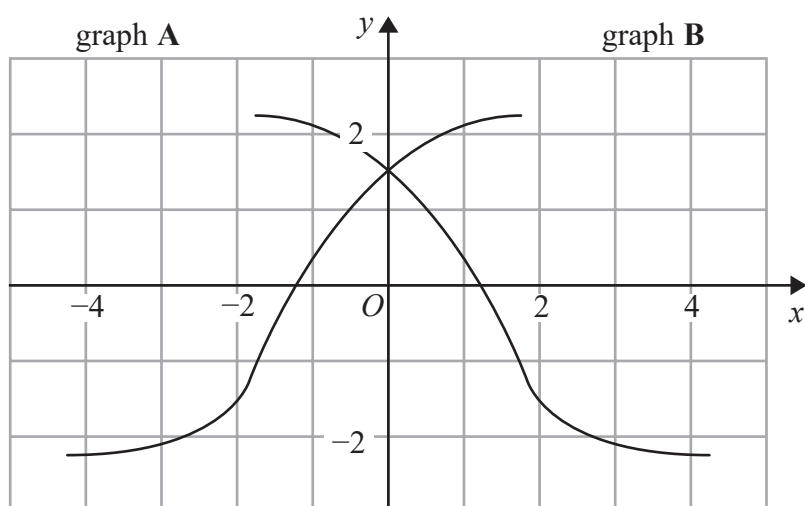What is the length of each side of the equilateral triangle?

.... cm

(Total for Question 1 is 5 marks)

2 The graph of $y = f(x)$ is shown on the grid below.

$y = f(x)$

(a) On the grid above, sketch the graph of $y = f(x - 3)$

(1)

graph **A**   graph **B**

On the grid, graph **A** has been reflected to give graph **B**.

The equation of graph **A** is $y = g(x)$

(b) Write down the equation of graph **B**.

....

(1)

(Total for Question 2 is 2 marks)

3 For all values of x

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

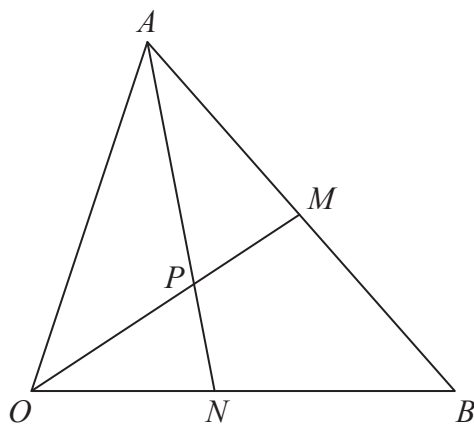(a) Find fg(x)

(2)

(b) Find the positive value of $f^{-1}(9)$

....

(2)

(Total for Question 3 is 4 marks)

4 Show that $\dfrac{(\sqrt{96} - \sqrt{24})^2}{\sqrt{6} - 2}$ can be written in the form $a(b + \sqrt{6})$ where a and b are integers.

(Total for Question 4 is 3 marks)

5

OAB is a triangle.
OPM and *APN* are straight lines.
M is the midpoint of *AB*.

$\overrightarrow{OA} = \mathbf{a}$ $\overrightarrow{OB} = \mathbf{b}$

OP : *PM* = 5 : 3

Work out the ratio *ON* : *NB*

....

(Total for Question 5 is 5 marks)

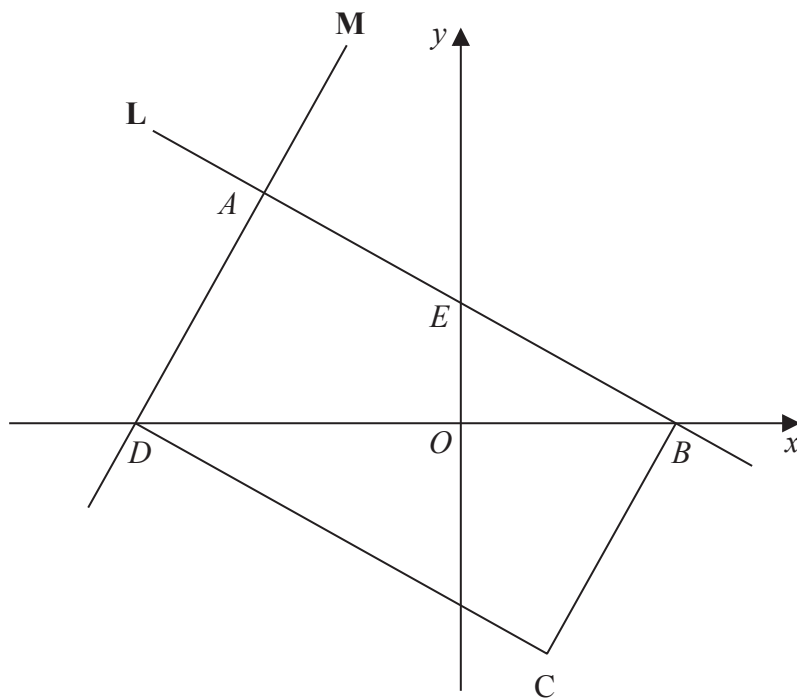**6** There are only green pens and blue pens in a box.

There are eight more blue pens than green pens in the box.

Simon is going to take at random two pens from the box.

The probability that Simon will take two pens of the same colour is $\dfrac{16}{31}$

Work out the number of green pens in the box.

....

(Total for Question 6 is 6 marks)

7

ABCD is a rectangle.

A, *E* and *B* are points on the straight line **L** with equation $3x + 4y = 12$
A and *D* are points on the straight line **M**.

AE = EB

Find an equation for **M**.

....

8 The table shows some values of x and y that satisfy the equation $y = a\cos x° + b$

x	0	30	60	90	120	150	180
y	1	$-3+\sqrt{3}$	-2	-3	-4	$-3-\sqrt{3}$	-5

Find the value of y when $x = 45$

....

(Total for Question 8 is 4 marks)

9 Show that $\dfrac{5+2\sqrt{3}}{2+\sqrt{3}}$ can be written as $4-\sqrt{3}$

(Total for Question 9 is 3 marks)

10 The two triangles in the diagram are similar.
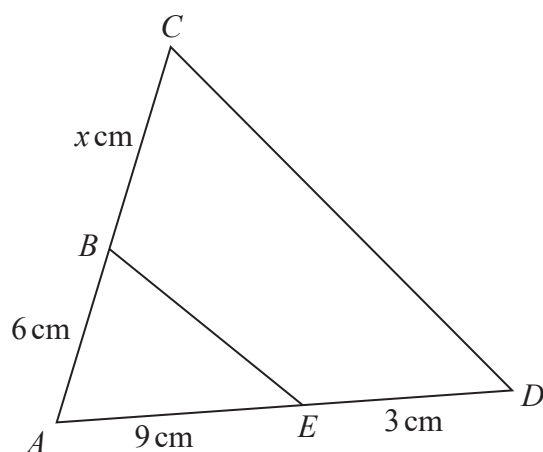
There are two possible values of *x*.

Work out each of these values.
State any assumptions you make in your working.