



## **Sixth Form Scholarship Examination**

### **Mathematics**

### **Specimen**

**Your Name.....**

**Your Current School.....**

**Time allowed: 1 hour 30 minutes**

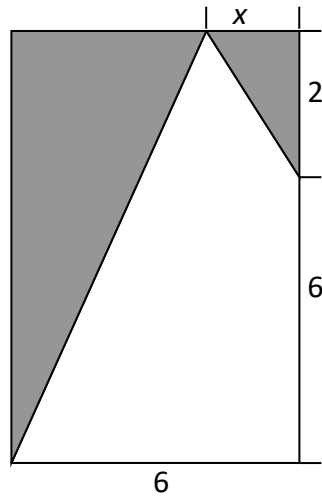
#### **Instructions:**

- **Calculators are NOT allowed.**
- **Answer all questions in the spaces provided. Except question 8 which should be done on a sheet of named graph paper and inserted into this booklet at the end**
- **Any extra sheets should be clearly labeled with your name and the question number and inserted into this booklet at the end**
- **Show all your working, credit can be given for this**
- **Marks for each question are given in brackets e.g. [2]**

1. Write  $0.\overline{0341}$  as a fraction with integer numerator and denominator.

[2]

2.  $\frac{2}{3}$  of the rectangle below is unshaded. What is the value of  $x$ ?



[3]

3. Solve the equation  $3x^2 - 14x - 5 = 0$ .

[3]

4. Make  $r$  the subject of the following formulae:

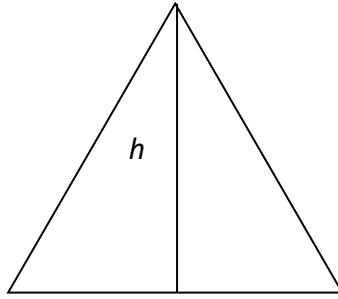
a)  $x = \frac{pr+v}{r-s}$

[2]

b)  $\frac{1}{a} + \frac{1}{b} = \frac{1}{r}$

[2]

5. This is an equilateral triangle with side length 2



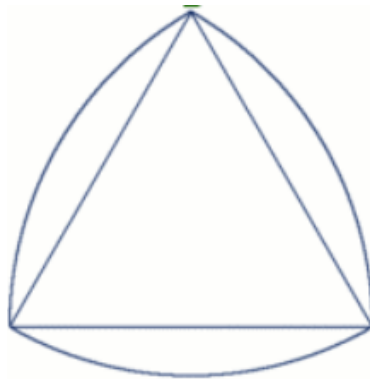
a) Find, as an exact square root, the height marked  $h$

[1]

b) Calculate the area of the equilateral triangle. Again, give your answer as an exact square root.

[1]

c) 3 circular arcs are drawn from each vertex of the equilateral triangle to form the shape below:



Calculate the area of this shape, leave your answer in terms of  $\pi$  and exact square roots.

[3]

6. a) Simplify as far as possible:

$$\frac{x+2}{x^2+5x+6}$$

[2]

b)

i. Factorise  $x^2 - 1$

[1]

ii. Hence write the following as a single fraction in its simplest terms

$$\frac{x+3}{x^2-1} - \frac{1}{x+1}$$

[3]

7. A quadratic graph has the equation  $y = a(x - b)^2 + c$ . It passes through (0,9) and has its vertex at (2,1). Calculate the values  $a, b$  and  $c$ . *Hint: you should start by sketching the curve.*

8. On the sheet of graph paper attached, sketch, on the same axes the graphs of :

a)  $y = \cos x^\circ$

[1]

b)  $y = \cos 2x^\circ$

[2]

c)  $y = 3\cos x^\circ$

[1]

You should label each graph clearly and use a scale of  $-360^\circ$  to  $360^\circ$

9. Bag A contains 2 black and 3 red discs. Bag B contains 3 black and 1 red disc. In an experiment, a bag is chosen at random and then a disc is pulled out of the bag, also at random.

a. Calculate the probability that the disc is red.

[2]

b. Given that the disc is red, find the probability that it came from bag A  
(Hint, imagine repeating the experiment 1000 times and then consider the distribution of outcomes)

[3]

10. Prove algebraically that the square of any odd number is always odd.

[3]

11. What is the last digit of  $3^{2014}$  ? Explain your answer fully.

[2]

**Total: 40 Marks**



