Candidate Name: ....

St Swithun's

Mathematics

Sixth Form Academic Assessment

Past Paper

Time allowed: 1 hour 30 minutes

Instructions to Candidates

All candidates should start at Question 1 and work through the paper until they finish or run out of time. Each question is worth 5 marks but the questions increase in difficulty as the question number increases.

Please note that the diagrams given in these questions are not to scale.

You may use a calculator.

Write your answers on file paper, not on the question paper.

Show all your working for each question.

Formulae

Sine Rule:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Cosine Rule:

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Mathematics Sixth Form Entrance Examination
Year of entry: 2011

1. Simplify:

a) $x(x-5)+6(x-3)$

b) $\frac{5x+1}{5} - \frac{3x+2}{3}$

2. Solve the following equations:

a) $x^2 + x - 56 = 0$

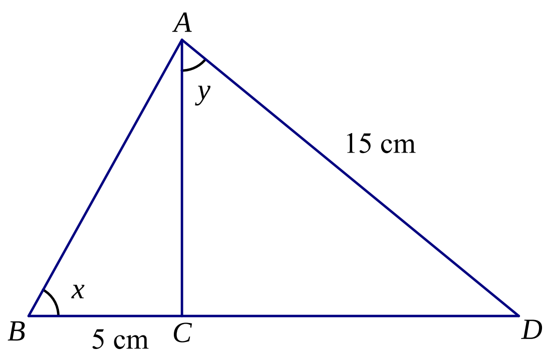
b) $5(x-3)+8 = 7(x+4)$

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

3. Solve the simultaneous equations:

$$x - 4y = 22$$
$$3x + 2y = -4$$

4. The diagram shows two right-angled triangles. AD = 15 cm and BC = 5 cm.

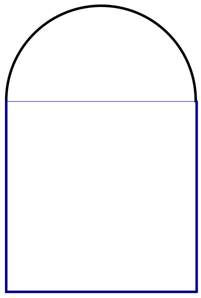


a) Given that $\tan x = 2.4$, calculate the length AC.

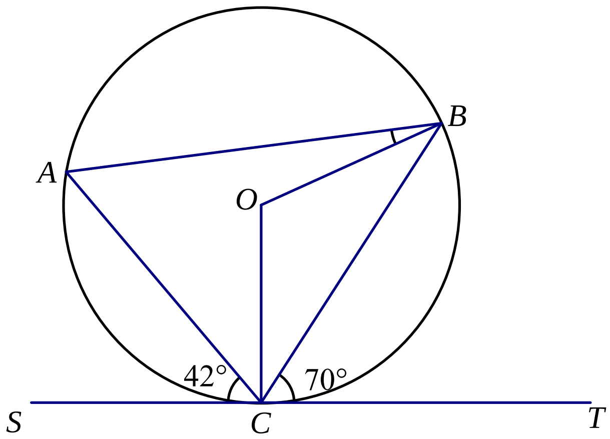
b) Calculate the value of $\tan y$.

5. Expand and simplify $(\sqrt{5}x + 2\sqrt{3})^2$

6. The shape shown below consists of a semicircle and a square.
If the area of the whole shape is 100 cm^2, calculate the radius of the semicircle.



7. *A*, *B* and *C* are points on the circumference of a circle with centre *O*.
SCT is a tangent to the circle. Angle $BCT = 70°$, angle $SCA = 42°$.



Calculate the size of angle OBA, showing your argument clearly and justifying each step.

8. Without using a calculator (so make sure you show enough working to make each step clear) find the exact value of

$$\frac{3\frac{1}{2} \times 1\frac{3}{14}}{6\frac{4}{5}}$$

9. Make w the subject of the formula $8rt - 4w = 3w(r - 3)$.

10. Find the equation of the line through the points $(-6, -1)$ and $(3, 2)$.

11. Solve the equation $\frac{6}{x-1} - \frac{4}{x+3} = 1.$

12. When $10^{20} - 90$ is written in full, what is the sum of the digits?

13. $x \bullet y$ is defined to be $xy - 10x - 10y + 110$.

    Find a number, e, with the property that $e \bullet y = y$ for any number y.

14. The product of four different positive integers is 100. What is the sum of these integers?

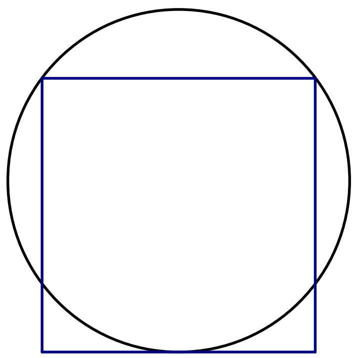
15. Consider the result of inserting three multiplication symbols between the digits 2, 3, 5, 6 and 7, in that order. For example, $2 \times 3 \times 5 \times 67 = 2010$
    What is the largest number that can be made in this way?
    Explain how you found your answer.

16. Two vertical poles are 3 metres and 2 metres tall. The top of each pole is attached to the bottom of the other by a taut rope. What is the height of the point where the ropes cross?

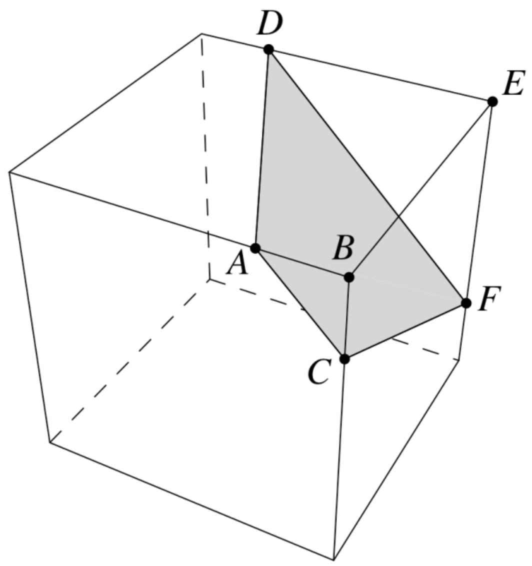
17. Consider the nine-digit numbers formed by using each of the digits 1 to 9 once and only once eg 123456789 and 312645987. How many of these numbers are prime? Be careful to justify your answer fully.

18. Explain why $x^3 - x$ is always a multiple of 6 if $x > 1$.

19. The diagram below shows a square and a circle.
    If the square has sides of length 2, what is the radius of the circle?



20. The edges of the cube shown below are 8 cm long.
Also $AB = BC = 2$ cm and $DE = EF = 6$ cm.
Find the area of the trapezium $ACFD$.



END OF QUESTIONS