

HARROW SCHOOL

ENTRANCE TEST FOR ENTRY IN 2017

Calculators may be used but clear and full working must be shown or no credit will be given

Answer all questions on paper not on the question paper

Time allowed: 90 minutes

1) Write the following as a power of 2

a) $\frac{4 \times 16}{2^7}$ b) $16\sqrt{16 \times 32}$ c) $\frac{16\sqrt{2}}{1/4}$

2) Simplify as much as possible:

ai) $\sqrt{32} + \sqrt{2} + 4\sqrt{8}$

ii) $\frac{\sqrt{15}}{\sqrt{27}}$

iii) $\sqrt{2}\sqrt{8} + \sqrt{72}$

bi) $\frac{5}{\sqrt{2}} + \sqrt{98}$

bii) $\frac{6}{\sqrt{2}-1} + \sqrt{8}$

3) Simplify as much as possible:

i) $3x(x + 2) + (x - 1)(x - 3)$

ii) $\frac{x+1}{x+2} \div \frac{x^2+3x+2}{x^2-x-6}$

iii) $\frac{3x}{x-2} - \frac{4x-1}{x^2-5x+6}$

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

4) Write down the next two terms and the n th term for the following sequences:

i) 19,12,5,

ii) $\frac{3}{5}, \frac{5}{7}, \frac{7}{9}$

iii) $1, \frac{3}{5}, \frac{1}{2}, \frac{5}{11}$

iv) 3,6,11,18

5) Factorise fully:

i) $3x^2 - 27x$

ii) $x^2 - 17x + 72$

iii) $6x^2 - 13x + 6$

iv) $ac + bc - ad - bd$

v) $3^{2x} - 4$

vi) $x^3 - 27$

6) Solve the following, giving your answer as simply as possible

i) $\frac{2^x}{4} = 8$

ii) $9^x = 3$

iii) $8^x = 4$

iv) $25^{2x} = 125$

7) Solve the following equations, answers to 3sf when appropriate:

i) $18 - 2x = \frac{2x-4}{7}$

ii) $\frac{x+3}{4} - \frac{x-4}{3} = 4$

iii) $\frac{x-2}{x+1} = \frac{x-7}{x+6}$

iv) $6x^2 - 13x = 28$

v) $x - 5\sqrt{x} + 6 = 0$

vi) $\frac{x+2}{x^2+5x-14} + \frac{3}{x+7} = 2$

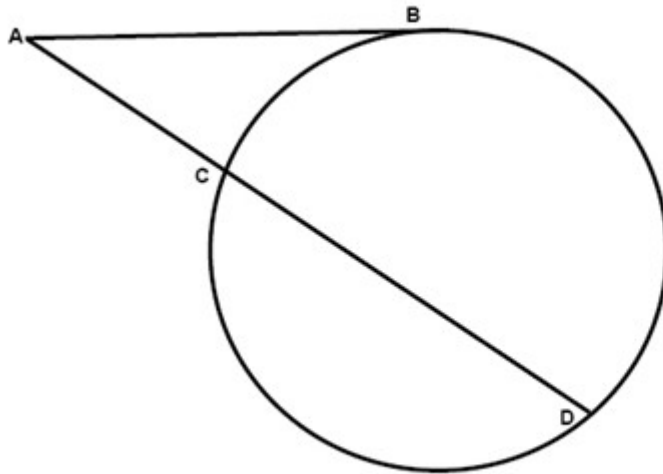
8) In triangle ABC, D is the point on AB such that AD=5 and DB=8. If DC=12 and AC=13 work out: i) the angle ABC and ii) The length of BC

9) A sphere is melted down and made into a cube with surface area equal to 13.5 cm^2 . What is the radius of the sphere? Leave your answer as an exact value.

10) In a football league, there are 20 teams who play each other twice in a season, both home and away, games being played on Saturdays at 3pm. How many matches are played in total? How many matches in total if there were n teams playing (n is even).

11) a) The radius of the Earth is 6371km. If I am 2m tall and stand at sea level how far can I see in a straight line?
b) If I can see for 30km in a straight line, how high off the ground am I standing?
c) If I stand on another planet and can see for 50km, what is the radius of the planet?

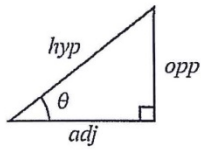
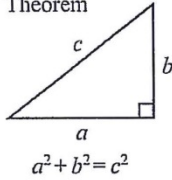
- 12) Prove that the sum of 4 consecutive odd numbers is always divisible by 8
- 13) AB is the diameter of a circle of centre O. Point C is on the circumference of the circle. If angle OAC is x , what is the angle OBC? Give full geometric justification for your answer. The radius of the circle is 10cm. If point D is the midpoint of OB and x is 55° , find the length of DC.
- 14) AB is tangent to the circle. Prove $AB^2 = AC \times AD$



If $DC = x + 2$, $AC = x + 1$ and $AB = x + 3$, find x

FORMULA SHEET

Pythagoras' Theorem

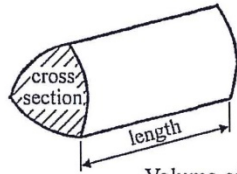


adj = hyp \times cos θ
 opp = hyp \times sin θ
 opp = adj \times tan θ

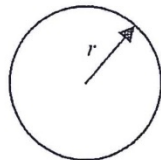
or $\sin \theta = \frac{\text{opp}}{\text{hyp}}$

$\cos \theta = \frac{\text{adj}}{\text{hyp}}$

$\tan \theta = \frac{\text{opp}}{\text{adj}}$

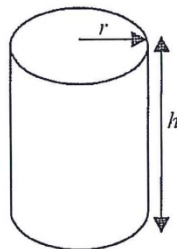


Volume of prism = area of cross section \times length



Circumference of circle = $2\pi r$

Area of circle = πr^2

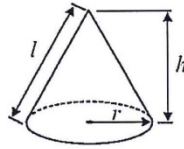


Volume of cylinder = $\pi r^2 h$

Curved surface area of cylinder = $2\pi r h$

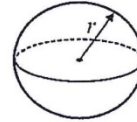
Volume of cone = $\frac{1}{3} \pi r^2 h$

Curved surface area of cone = $\pi r l$

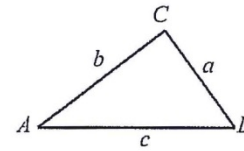


Volume of sphere = $\frac{4}{3} \pi r^3$

Surface area of sphere = $4\pi r^2$



In any triangle ABC

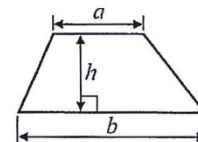


Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

Area of triangle = $\frac{1}{2} ab \sin C$

Area of a trapezium = $\frac{1}{2} (a + b) h$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

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