Year 1 Pure Mathematics Examination Revision Health Check N° 2



I went to the Library to get a medical book on abdominal pain. Somebody had ripped the appendix out...

Any solution based entirely on graphical or numerical methods is not acceptable Marks Available : 50

Question 1

Given a curve, y = f(x), if y is replaced with $\frac{y}{3}$ all distances from the x-axis are tripled and if x is replaced with 2x all distances from the y-axis halve. Use these facts to sketch the graph of $\frac{y}{3} = sin(2x)$ on the grid below.



[3 marks]

(i) Show that
$$\frac{1 - tan^2 x}{1 + tan^2 x} = 2\cos^2 x - 1$$

[6 marks]

(ii) Hence solve
$$\frac{1 - tan^2 x}{1 + tan^2 x} = \frac{1}{8}$$
 over the interval $0^\circ \le x \le 360^\circ$

[5 marks]

(i) On the same graph sketch the curve $y = (x - 1)^2 (x + 1)^2$ and the straight line y = 1, paying particular attention to any points where an axis is touched or crossed.

[5 marks]

(ii) Find all solutions to the equation,
$$(x - 1)^2 (x + 1)^2 = 1$$

[4 marks]

(iii) Solve
$$\left(\frac{1}{\cos x} - 1\right)^2 \left(\frac{1}{\cos x} + 1\right)^2 = 1, \ 0 \le x \le 360, \ x \ne 90, \ 270$$

[4 marks]

To translate any curve by the vector $\begin{pmatrix} a \\ b \end{pmatrix}$

- replace x with x a
- replace y with y b
- (i) Given that the equation of a circle centre (0, 0), radius r is $x^2 + y^2 = r^2$ deduce the equation of a circle of radius 13 that has been translated $\begin{pmatrix} 5\\12 \end{pmatrix}$

[3 marks]

(ii) The parabola
$$y = x^2$$
 is to be translated $\begin{pmatrix} 4 \\ -7 \end{pmatrix}$

What is the equation of the translated parabola?

Give your answer in the form $y = ax^2 + bx + c$ where a, b and c are integers the values of which you have determined.

(iii) The inverse proportion graph, $y = \frac{1}{x}$ is translated so that the asymptotes are at x = 5 and y = 1. Find the equation of the transformed graph in the form $y = \frac{ax + b}{cx + d}$ where *a*, *b*, *c* and *d* are integers, the values of which you have determined.

[5 marks]

Question 5

In $\triangle ABC$, AB = 16 cm, AC = 13 cm, $\angle ABC = 50^{\circ}$ and $\angle BCA = x^{\circ}$ Find the two possible values for *x*, giving your answers to one decimal place.

[4 marks]

The parabola shown below crosses the x-axis at (-5, 0) and (4, 0) and it crosses the y-axis at (0, -5)



(i) Determine the equation of the parabola in the form y = f(x)

[4 marks]

(ii) Solve the related equation f(x - 3) = 0

[3 marks]

This document is a part of a **Mathematics Community Outreach Project** initiated by Shrewsbury School It may be freely duplicated and distributed, unaltered, for non-profit educational use In October 2020, Shrewsbury School was voted "**Independent School of the Year 2020**" © 2021 Number Wonder

Teachers may obtain detailed worked solutions to the exercises by email from mhh@shrewsbury.org.uk