Year 1 Pure Mathematics Examination Revision
Health Check N° 3

When you get a bladder infection, urine trouble...

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

Question 1

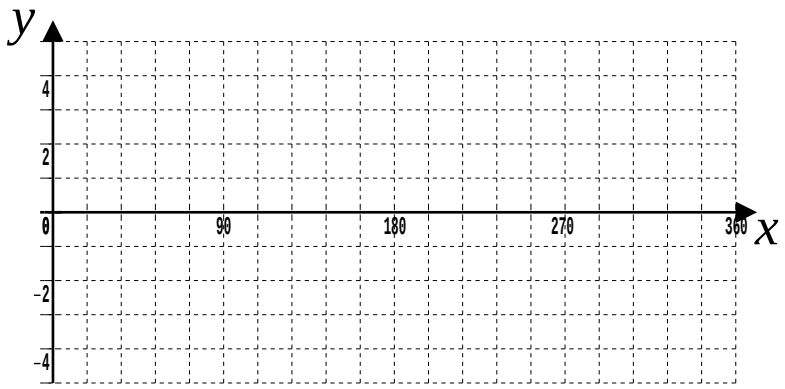
Show that, $cos^4 x - sin^4 x = 1 - 2 sin^2 x$

[4 marks]

Question 2

Given a curve, $y = f(x)$, if y is replaced with $\frac{y}{4}$ all distances from the x-axis are quadrupled and if x is replaced with $(x - 36°)$ the graph translates $\begin{pmatrix} 36 \\ 0 \end{pmatrix}$

Use these facts to sketch the graph of $y = 4\sin(x - 36)$ on the grid below.



[3 marks]

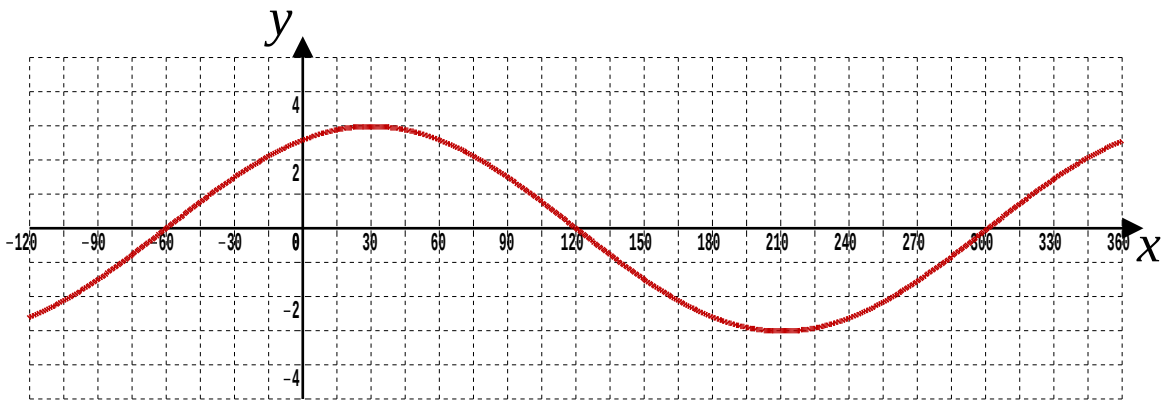
Question 3

Expand the brackets and simplify, $\frac{(1 + x)^8 - (1 - x)^8}{16}$

[5 marks]

Question 4

The curve shown has an equation of the form $y = a\sin(x + b)$ for some constants a and b and where x is measured in degrees.



(i) Find the value of a giving a clear reason for your answer.

[2 marks]

(ii) Find the value of b giving a clear reason for your answer.

[2 marks]

(iii) Consider solving an equation of the form,

$$a\sin(x + b) = k,$$

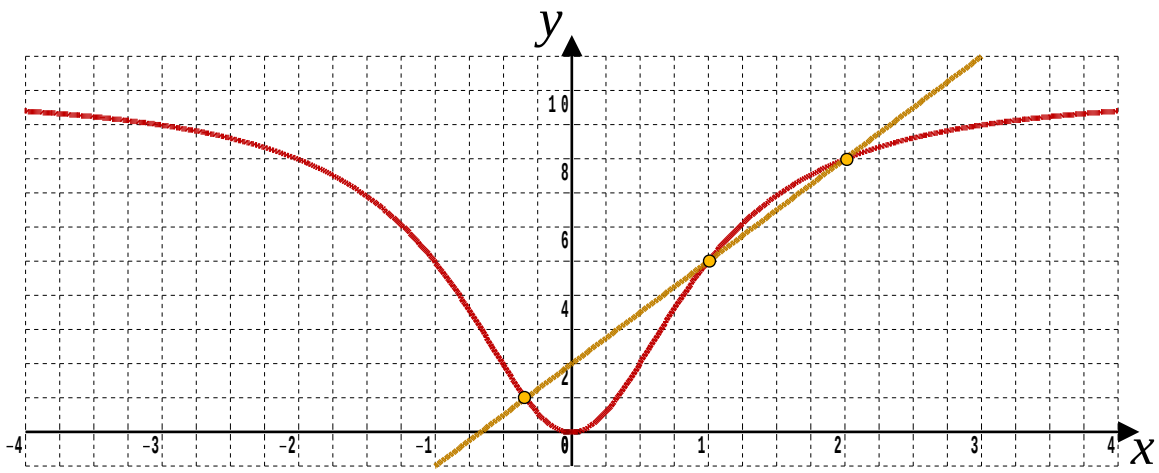
where k is a positive constant.

State the range of possible values for k for which the equation has solutions. Again, give a reason for your answer.

[2 marks]

Question 5

Peyton has graphed the curve $y = \dfrac{10x^2}{x^2 + 1}$ and the straight line $y = 3x + 2$



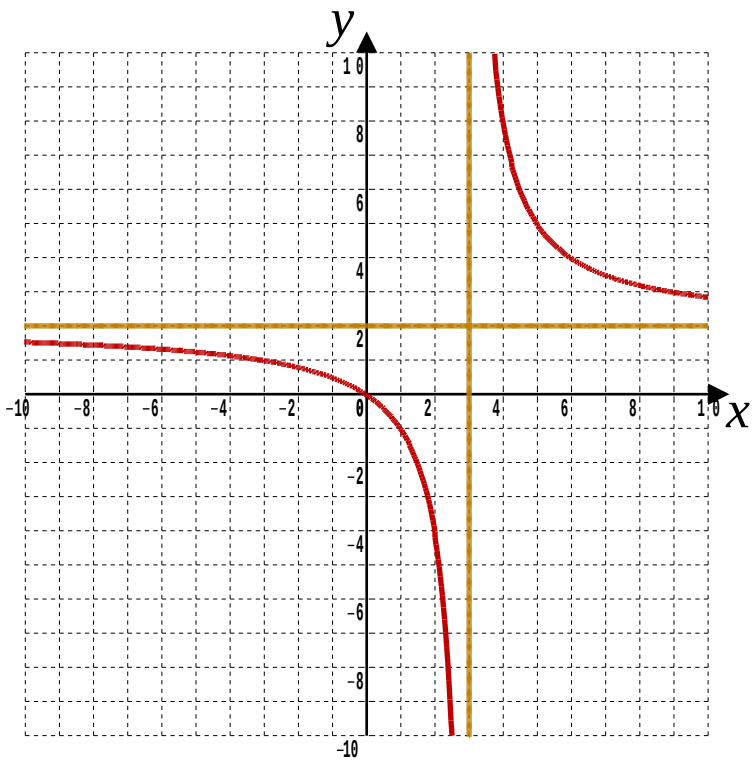
Use algebra to determine the exact coordinates of all three points of intersection.

[6 marks]

Question 6

The graph of inverse proportionality has been translated such that its asymptotes are $x = 3$ and $y = 2$.

Furthemore the translated graph passes through the origin.



Determine the equation of the translated curve in the form $y = \dfrac{ax + b}{cx + d}$ where a, b, c and d are integers, the values of which you have determined.

[6 marks]

Question 7

Oxford University Mathematics Admission Test, 2017, Q(B)

(i) By completing the square, or otherwise, find the minimum value of,

$$f(x) = 9\cos^4 x - 12\cos^2 x + 7$$

[6 marks]

(ii) Find the four values of x between 0° and 360° that give rise to the minimum value of,

$$f(x) = 9\cos^4 x - 12\cos^2 x + 7$$

Give your answers to one decimal place.

[4 marks]

Question 8

From applying the binomial theorem it is known that the first three terms of,

$$\left(1 + \frac{x}{3}\right)^{18} = 1 + 6x + 17x^2 + \ldots$$

Use this expansion to find an estimate of the value of 1.01^{18}, giving your answer to 4 decimal places.

[4 marks]

Question 9

Oxford University Mathematics Admission Test, 2010, Q(A)

Find the values of k for which the straingh line with equation $y = kx$ intersects the parabola with equation $y = (x - 1)^2$

[6 marks]