



Mathematics Homework

Maths in Action: Higher
October week: Unit 1



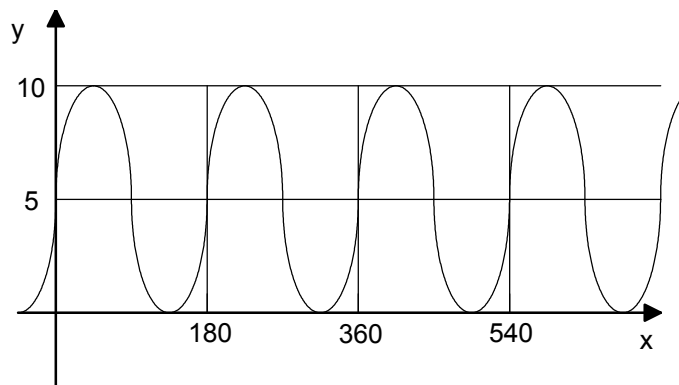
Show all Working: Use a calculator sparingly!

- Find the equation of the line passing through the pair of points $(-1, -6)$ and $(5, -2)$.
- Find the equation of the line parallel to the line with equation $2x + 5y + 4 = 0$ and passing through the point $(-1, 4)$.
- The vertices of a triangle are $A(1, 8)$, $B(-12, -2)$ and $C(8, -6)$.
 - Draw a rough sketch of triangle ABC showing the median through A and the altitude through B.
 - Find the equation of the median through A.
 - Find the equation of the altitude through B.
 - Use simultaneous equations to find the point of intersection, D, of the lines you found in parts b) and c).
 - Show that the distance CD is $2\sqrt{41}$.
- Sketch the graphs (for $0 \leq \theta \leq 2\pi$) on the grids attached on page 4.
 - $y = 3 \sin 2\theta$
 - $y = 2 \cos(\theta - \frac{\pi}{4}) + 1$

- The equation of the curve opposite can be written in the form

$$y = a \sin bx + c$$

Find the values of a , b and c .



- Two functions are defined as $f(x) = 2x + 1$ and $g(x) = \frac{1}{x}$
 - Find i) $f(g(x))$ ii) $g(f(x))$
 - Find the value of x for which $g(f(x)) = \frac{1}{9}$
- Find the inverse functions of:
 - i) $f(x) = x^2 - 1$ ii) $g(x) = \frac{2}{x+2}$
 - Write down a suitable domain for the function $f^{-1}(x)$.

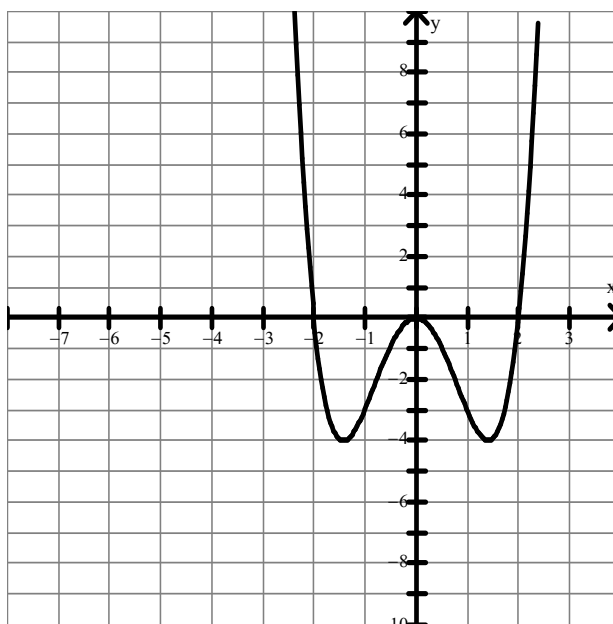
8. Differentiate the following,

- a) $y = x^4$ b) $f(x) = x^{-5}$ c) $y = x^{\frac{5}{3}}$
 d) $f(x) = \frac{1}{x^3}$ e) $y = \frac{1}{\sqrt[4]{x^7}}$ f) $y = x^3(x^4 + 1)$
 g) $f(x) = (x+2)(3x-4)$ h) $f(x) = (x^2 - 5)(2x^2 - 1)$
 i) $y = \frac{3x^2 + 4x + 5}{x}$ j) $f(x) = \frac{1 - 2x - 3x^2}{4\sqrt{x}}$

9. a) Complete the square to show that $y = x^2 - 8x + 21$ can be written in the form $y = (x + b)^2 + c$, where b and c are integers.
 b) Hence make a sketch of this quadratic clearly showing the y-intercept. Some help is available on page 4.
 c) State the minimum value of this quadratic.
 d) Write down the equation of the axis of symmetry of this quadratic.
 e) The line $y = 2x + 10$ intercepts this quadratic at two points. Find these two points (correct to 1 decimal place). You can verify your answers using WinPlot on a PC if you have the WinPlot program available.

10. The graph of $f(x) = x^2(x^2 - 4)$ is shown opposite.

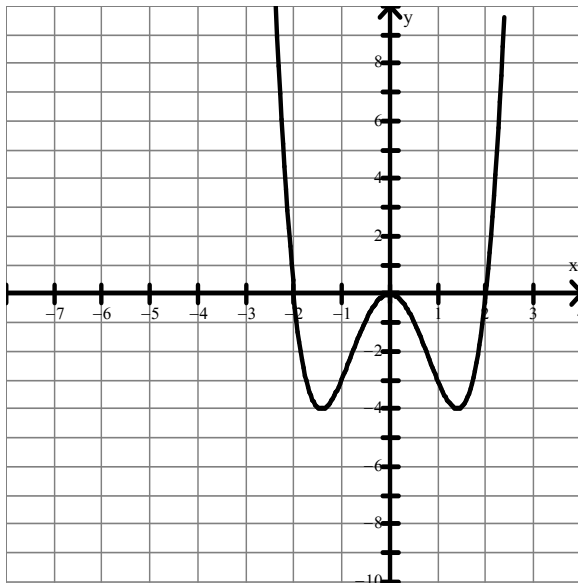
- a) There are 3 copies of this graph attached on page 3.
 Use the first one to also show the graph of $f(x) + 4$. State the minimum value of $f(x) + 4$ and state the range.
 b) Use the second copy to also show the graph of $-f(x)$.
 State all 3 roots of $-f(x)$.
 State the range of $-f(x)$.
 c) Use the third copy to also show the graph of $f(x + 4)$ and state all 3 roots of this function.
 show that
 $f(x + 4) = x^4 + 16x^3 + 92x^2 + 224x + 192$
 and use this to verify any one of your roots (substitute the root into the above and you should get zero!).



That's it!! The telly is rubbish over the holiday so this homework had better be completed on time.

Graphs for question 10.

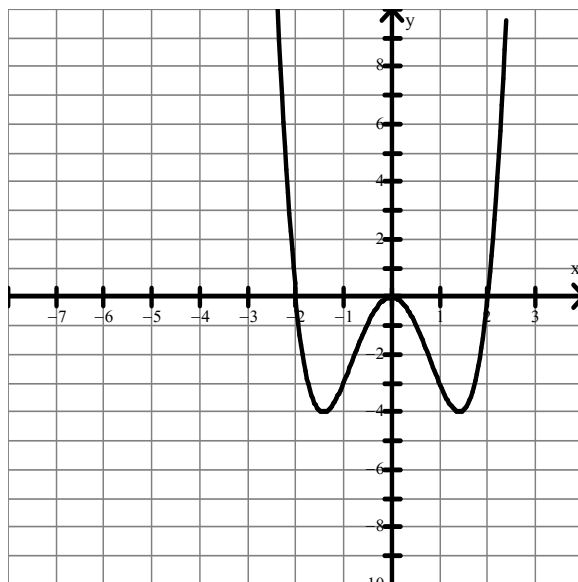
a)



Minimum value
of $f(x) + 4$ is _____

Range of $f(x) + 4$ is _____

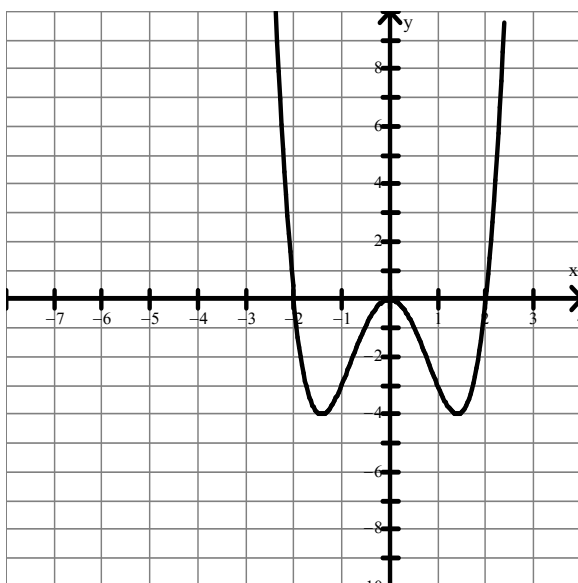
b)



The 3 roots of $-f(x)$ are

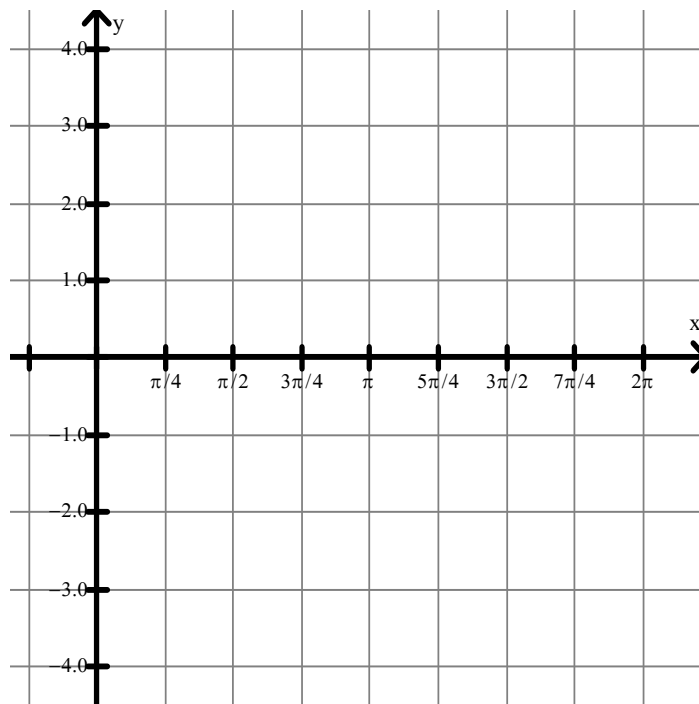
Range of $-f(x)$ is _____

c)

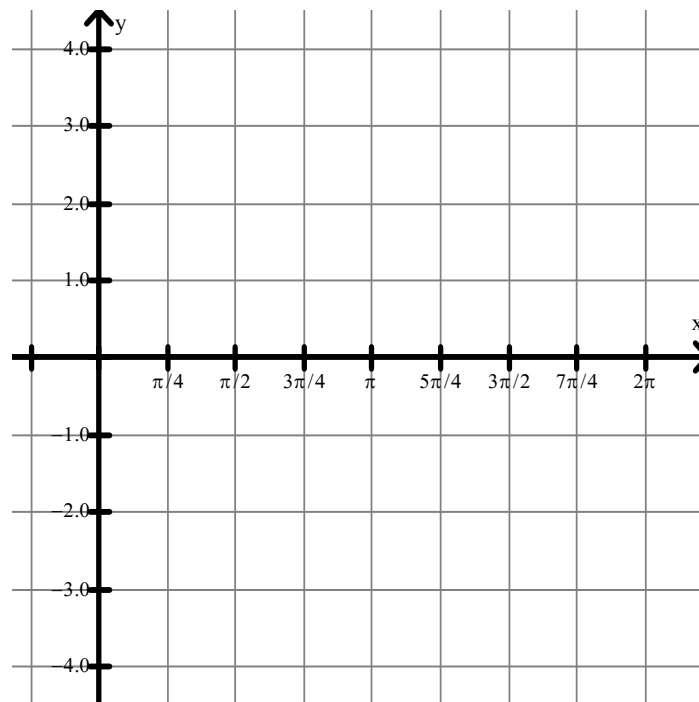


The 3 roots of $f(x + 4)$ are

4a) $y = 3 \sin 2\theta$



4b) $y = 2 \cos(\theta - \frac{\pi}{4}) + 1$



Here is some help for question 9.

The diagram illustrates the equations

$y = x^2 - 8x + 21$

And

$y = 2x + 10$

You should be able to see if your answers are sensible.

