

Pure 29 – Modulus Function and Graph Transformations

Please **complete** this homework by _____. Start it early. If you can't do a question you will then have time to ask your teacher for help or go to a drop in session.

Section 1 – Review of previous topics. Please complete all questions.

- An arithmetic sequence has first term 6 and common difference 2.
 - Write down the first 3 terms.
 - Find the 42nd term.
 - Find an expression for the nth term.
 - Find the **sum** of the first 14 terms.
- Write out fully the terms of the series given, then evaluate each sum:
 - $\sum_{r=1}^4 (2r + 3)$
 - $\sum_{r=0}^3 2 \times 3^r$
 - $\sum_{r=1}^4 (-1)^r r^2$
- For each sequence given, list the first four terms and hence state whether the sequence is convergent or divergent.
 - $u_{n+1} = 4u_n - 1, u_1 = 2,$
 - $u_n = 3 + 0.2^n$
- For the geometric sequence 2, 6, 18,.....
 - state the value of the common ratio.
 - write down the next two terms.
 - find the thirteenth term.

5. The **second** and **fifth** terms of a geometric series are 9 and 1.125 respectively.

For this series find

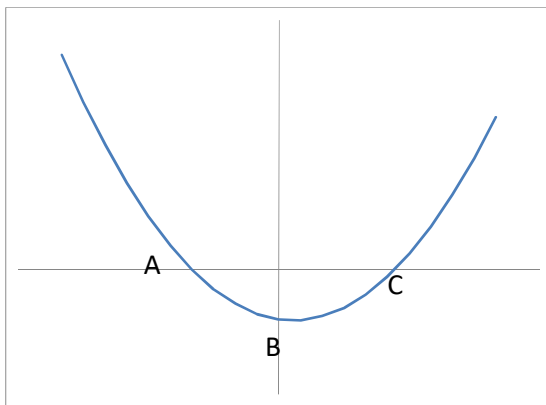
- the value of the common ratio,
- the first term,
- the sum to infinity.

6. a) Find the coordinates of C, the centre of the circle

$$x^2 + y^2 - 10x - 8y + 21 = 0. \quad \text{Hint: use completing the square.}$$

- b) The circle cuts the x-axis at the points A and B. Given that A is (3, 0) find the co-ordinates of B.

7. The graph of $y = 3x^2 - x - 4$ is shown below; find the co-ordinates of the points A, B and C.



Section 2 – Consolidation of this week’s topic. Please complete all questions.

1. State (i.e. describe in words) the series of transformations which map

a) $e^x \rightarrow 3e^{-x}$ b) $\ln x \rightarrow 2 \ln (x + 3)$ c) $\cos x \rightarrow -\cos 2x$ (6)

2. Sketch the functions given

a) $y = |4 - x| + 1$ b) $y = |x(x + 2)|$ (4)

3. Sketch the functions given

a) $y = \sin(|x|+45)$ b) $y = |x|^2 - 2|x| + 1$ (5)

4. Solve for x

a) $|x| = \frac{1}{2}x + 4$ b) $|x| = 5 - x$.

Explain with the aid of a sketch why there is only one answer to part (b) (5)

5. Solve for x, $3|x| > |x+1|$. Show the solution on a sketch graph. (4)

6. The function f is defined by $f(x) = 2 \ln(x - 3)$, $x \in \mathbb{R}$, $x > 3$.

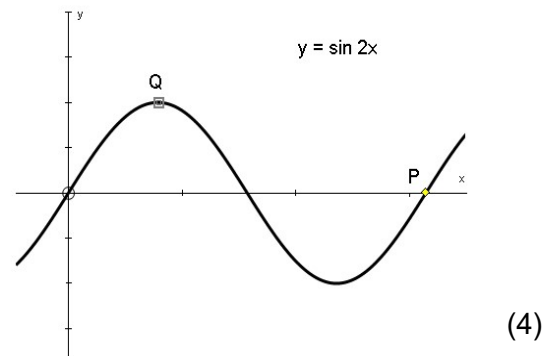
On separate axes, sketch the graphs of i) $y = f(x)$, ii) $y = |f(x)|$. (4)

7. Part of the graph of $y = 3 \sin 2x$ is shown.

a) State the period of $3 \sin 2x$.

b) State the x co-ordinate of P in terms of π .

c) State the co-ordinates of Q.



d) Describe the transformations which map

$y = \sin x$ on to $y = 3 \sin 2x$. (2)

8. The function f is defined for all real values of x by

$$f(x) = |2x - 3| - 1.$$

a) Sketch the graph of $y = f(x)$. Indicate the coordinates of the points where the graph crosses the x-axis and the coordinates of the point where the graph crosses the y-axis. (5)

b) Find the values of x for which $f(x) = x$ (3)

9.

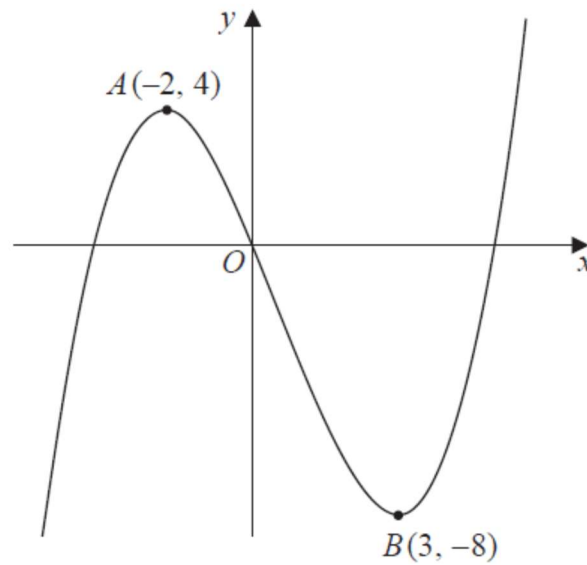


Figure 2

Figure 2 shows a sketch of part of the curve with equation $y = f(x)$. The curve has a maximum point A at $(-2, 4)$ and a minimum point B at $(3, -8)$ and passes through the origin O .

On separate diagrams, sketch the curve with equation

(a) $y = 3f(x)$, (2)

(b) $y = f(x) - 4$. (3)

On each diagram, show clearly the coordinates of the maximum and the minimum points and the coordinates of the point where the curve crosses the y -axis.

(Total 5 marks)

Total: 47 marks