

# Pure 1 – 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.

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

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

For this series find

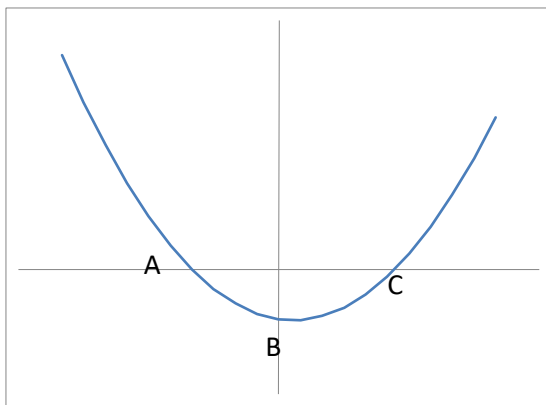
- the value of the common ratio,
- the first term,
- the sum to infinity.

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  $f(x) = 2 \ln(x - 3)$ ,  $x \in \mathbb{R}$ ,  $x > 3$ .

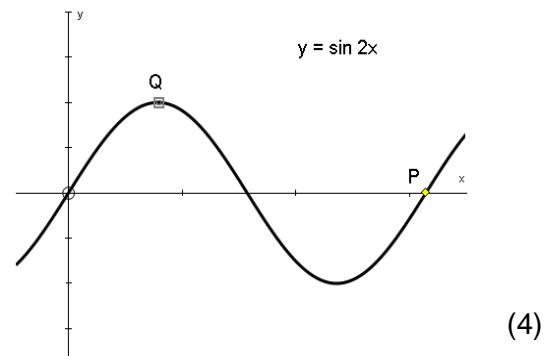
On separate axes, sketch the graphs of i)  $y = f(x)$ ,      ii)  $y = |f(x)|$ . (4)

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  $\pi$ .

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.

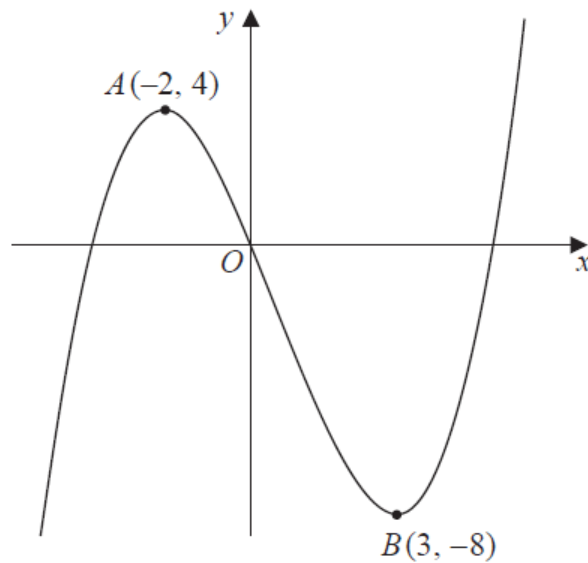
**Figure 2**

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**