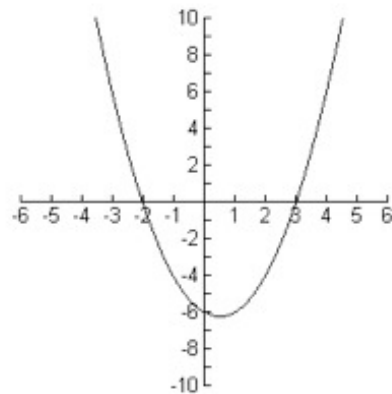


# Algebra and Functions – Paper 1 (non-Calculator)

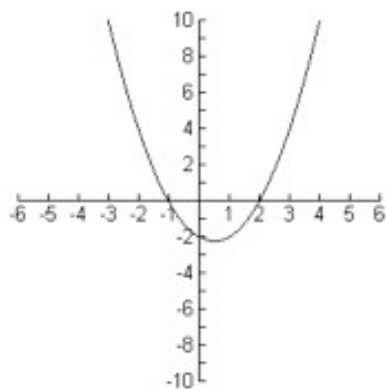
IB HL

Part A [30 marks]

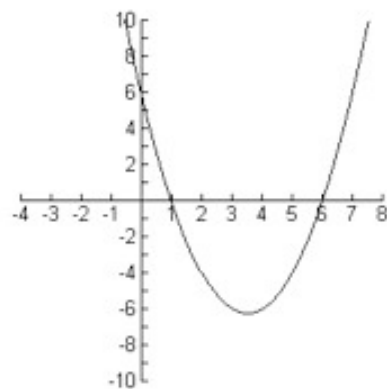
1. The graph below shows the equation of a function  $f(x)$ .



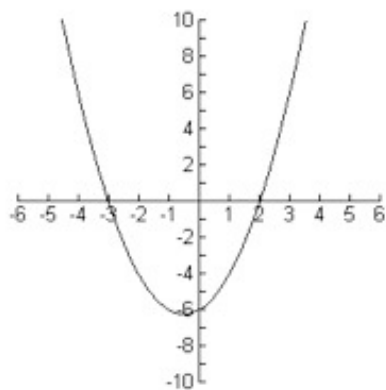
a)



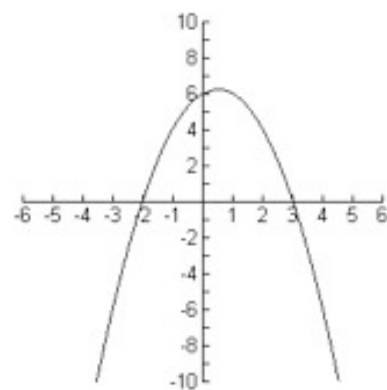
b)



c)



d)



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Match the correct transformation (a) to (d) with the correct number (i) to (iv).

(i)  $f(x) + a$

(ii)  $f(-x)$

(iii)  $-f(x)$

(iv)  $f(x - a)$

a) ..... b) ..... c) ..... d) .....

2.  $f(x) = x^3 - 3x^2 - 10x + 24$

a) Show that  $(x-4)$  is a factor of  $f(x)$ .

b) Hence find the other 2 factors of  $f(x)$ .

.....

3. The quadratic equation  $3x^2 + kx + 5 = 0$  has 2 solutions.

Find the values that  $k$  can take giving your answer as a surd.

.....

4.  $x = \log_a 5$  and  $y = \log_a 2$ .

Find in terms of  $x$  and  $y$ ,

a)  $\log_a 100$ ,

b)  $\log_2 25$ .

a) .....

b) .....

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5. Solve the equation  $8e^{x+1} = 9$  giving your answers in terms of  $\ln 2$  and  $\ln 3$ .

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Part B [26 marks]

6. [Maximum mark 13]

- i) Consider the function  $f(x) = x^2 + 6x + 16$ .
- a) Write  $f(x)$  in the form  $(x + a)^2 + b$ , where  $a$  and  $b$  are real numbers. [3 marks]
  - b) Give the vertex of  $f(x)$ . [2 marks]
- ii) The function  $g(x) = \frac{2}{x-1} + 3$ , where  $x$  can be any real number,  $x \neq 1$ .
- a) Sketch the graph of  $g(x)$ . [2 marks]
  - b) Find  $g(x)^{-1}$ , the inverse of  $g(x)$ . [3 marks]
  - c) State the range of  $g(x)^{-1}$ . [1 mark]
  - d) What is the geometrical transformation that maps  $g(x)$  onto  $g(x)^{-1}$ . [2 marks]

7. [Maximum mark 13]

- i) The first two terms of a geometric series are 75 and 60 respectively. Find,
- a) the common ratio of the series, [1 mark]
  - b) the sum to infinity, [2 marks]
  - c) the smallest number of terms of the series whose sum exceeds 90% of the sum to infinity. [4 marks]
- ii) The sum,  $S_n$ , of the first  $n$  terms of an arithmetic series is given by  $S_n = 2n^2 + 8n$ . Find,
- a) the value of the 12<sup>th</sup> term, [3 marks]
  - b) the smallest term of  $n$  for which the  $n^{\text{th}}$  term exceeds 600. [3 marks]

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## Answers

### Part A

1. a) (i)            b) (iv)            c) (ii)            d) (iii)

2. b)             $(x - 2)(x + 3)$

3.  $k > 2\sqrt{15}$  and  $k < -2\sqrt{15}$

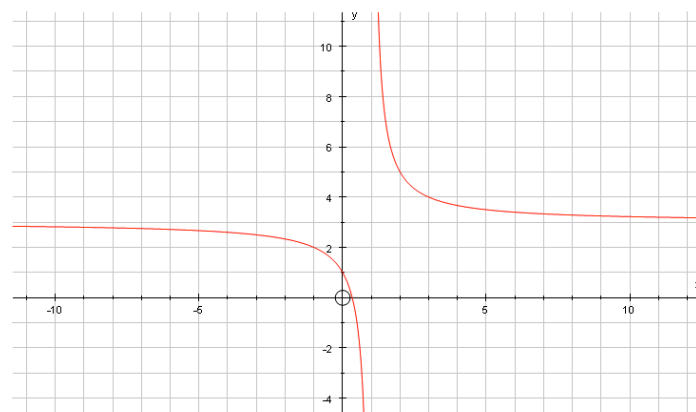
4. a)  $2(x + y)$             b)  $\frac{2x}{y}$

5.  $3(\ln 3 - \ln 2) - 1$

### Part B

6. i) a)  $(x + 3)^2 - 7$             b)  $(-3, -7)$

ii) a)



b)  $g(x)^{-1} = \frac{x - 1}{x - 3}$

c)  $x \in \mathbb{R}, x \neq 1$

d) Reflection in the line  $y = x$ .

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7. i) a)  $\frac{4}{5}$       b) 375      c)  $n=11$
- ii) a) 54      b) 149