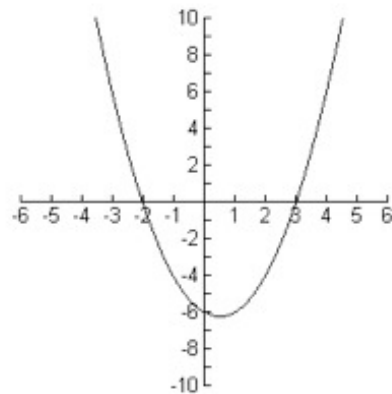


Algebra and Functions – Paper 1 (non-Calculator)

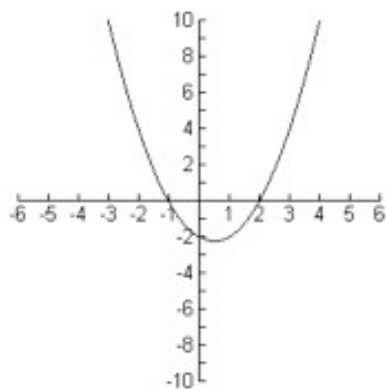
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Part A [30 marks]

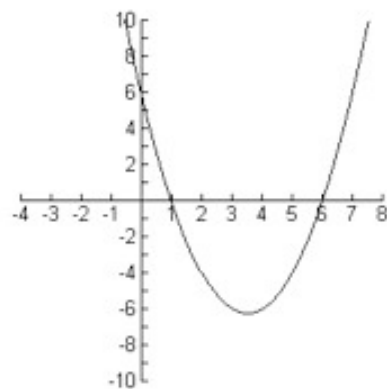
1. The graph below shows the equation of a function $f(x)$.



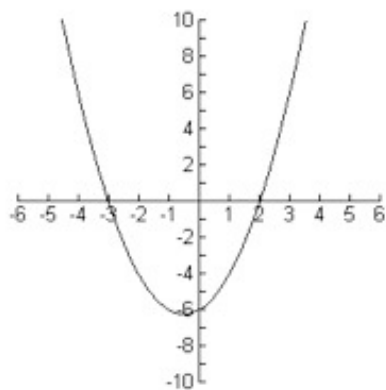
a)



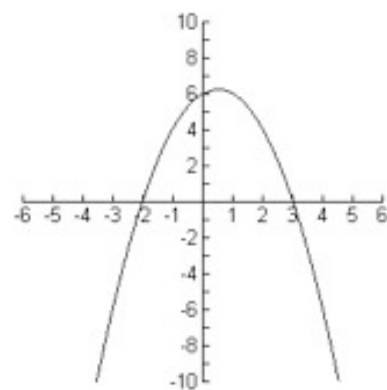
b)



c)



d)



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. Find the first 3 terms in the expansion of $(2 + 5x)^5$.

.....

3. Consider the functions $f(x) = 2x - 1$ and $g(x) = \frac{5 - x}{2}$.

a) Find $g(x)^{-1}$.

b) Calculate $(f \circ g^{-1})(x) = 5$

a)

b)

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

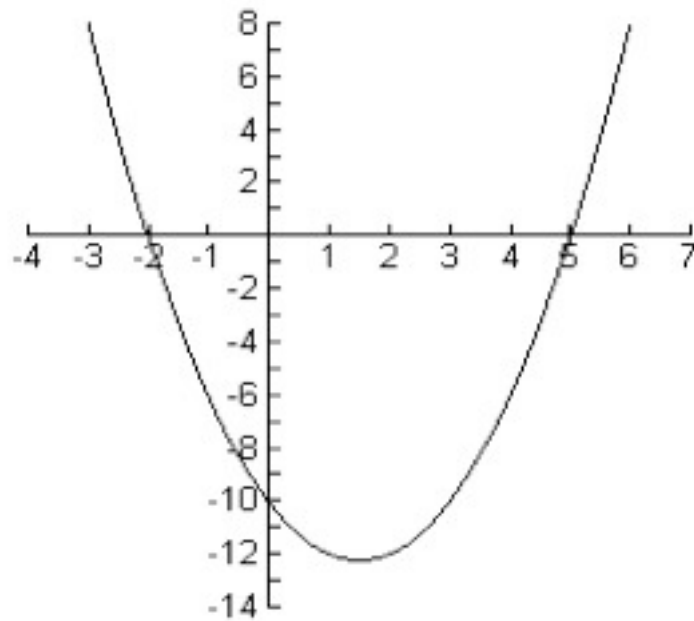
Find the values that k can take giving your answer as a surd.

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5. The diagram below shows part of the equation of the curve $y = ax^2 + bx + c$.



Find the value of,

- a) b ,
- b) c .

a)

b)

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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 12th term, [3 marks]
- b) the smallest term of n for which the n^{th} term exceeds 600. [3 marks]

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Answers

Part A

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

2. $32 + 400x + 2000x^2$

3. a) $5 - 2x$ b) $x = 1$

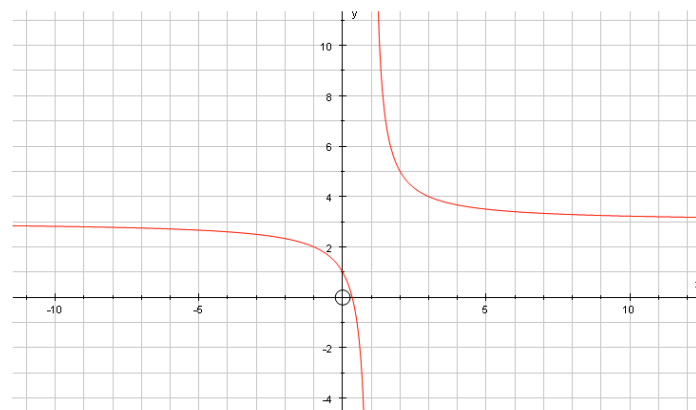
4. $k > 2\sqrt{15}$ and $k < -2\sqrt{15}$

5. a) -3 b) -10

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