IB HL
Mathematics **By Rakesh Jha**

Test: Functions - Basics

Show your working clearly in the space provided. total marks on test: **75**

Part I – NO calculator >> Questions 1-6

1. Consider the quadratic function $g(x)=3x^2+12x+8$.

(a) Express $g(x)$ in the form $g(x)=a(x-h)^2+k$. State the values of *a*, *h* and *k*. **[4 marks]**

(b) State the domain and range for $g(x)$. **[4 marks]**

(c) Briefly explain why the inverse of $g(x)$ is not a function. **[2 marks]**

(d) Restrict the domain of $g(x)$ in such a way that the domain is as large as possible but so that the inverse of $g(x)$ will be a function. State this 'new' restricted domain for $g(x)$. **[2 marks]**

(e) For $g(x)$ having the domain stated in (d), find $g^{-1}(x)$. **[3 marks]**

2. Draw an accurate sketch of the absolute value function $y=-|x+2|+5$. Clearly label (giving coordinates) the 'vertex' of the graph and any *x*-intercepts or *y*-intercepts. **[5 marks]**

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3. State the domain and range for each function.

(a) $f(x)=\sqrt{4-x}$ **[3 marks]**

(b) $h(x)=10^{x-3}$ **[3 marks]**

(c) $g(x)=\dfrac{5}{x+5}$ **[3 marks]**

4. Let $f(x)=\dfrac{1}{x+1}$, $x\neq -1$ and $g(x)=\dfrac{x}{3}-1$. If $h=g\circ f$, find:

(a) $h(x)$ and express it as a single simplified fraction. **[3 marks]**

(b) $h^{-1}(x)$ and express it as a single simplified fraction . **[3 marks]**

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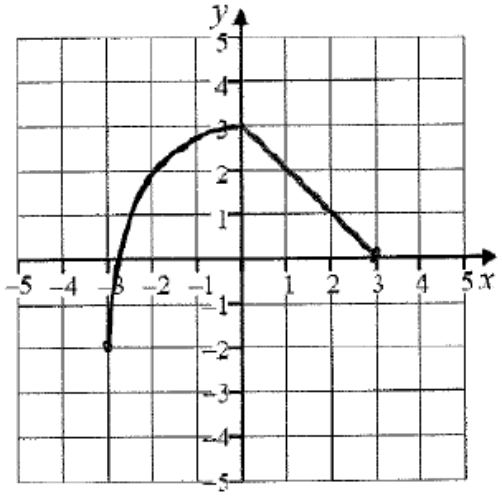
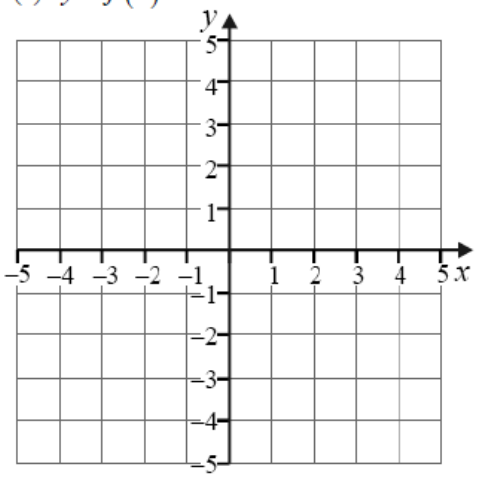
5. The diagram shows a sketch of the graph of $y=f(x)$, $-3\leq x\leq 3$. **[3 marks each]**

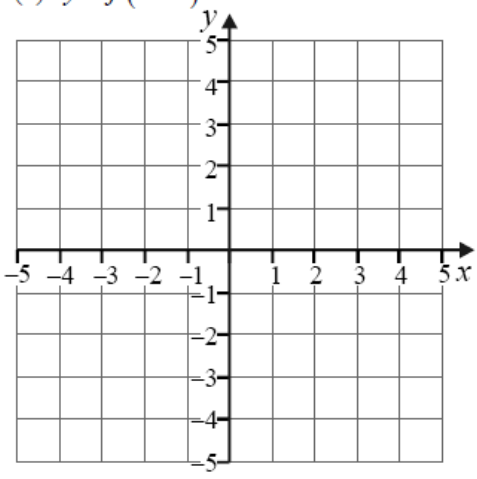


Sketch each of the graphs with the following equations.

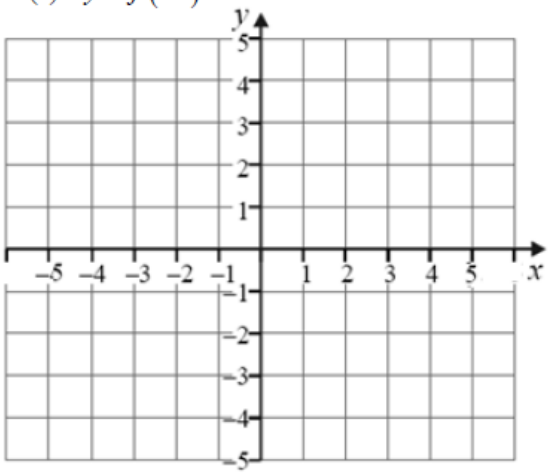
(a) $y = f(x) + 2$



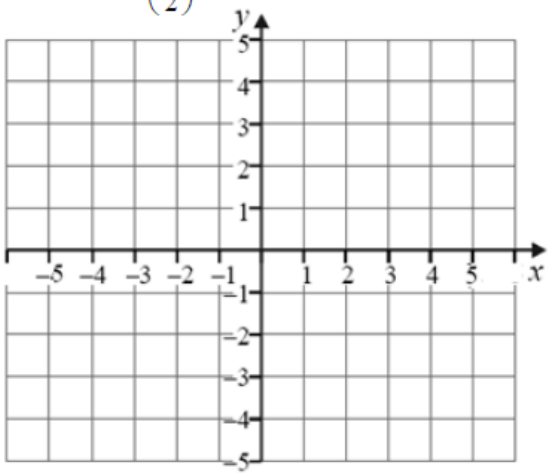
(b) $y = f(x + 2)$



(c) $y = f(-x)$



(d) $y = f\left(\frac{x}{2}\right)$



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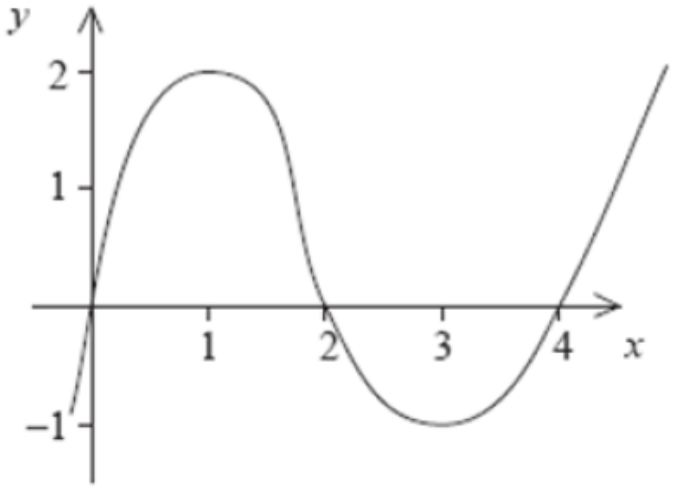
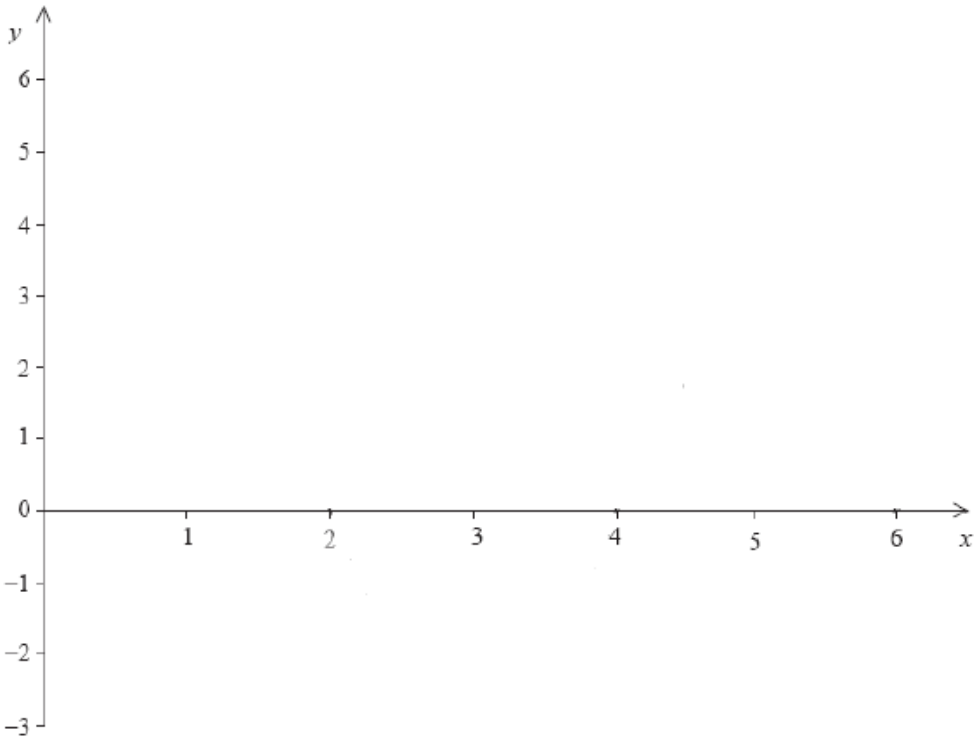
6. Below is the graph of the function $y = f(x)$ **[3 marks]**



On the coordinate plane below, sketch a graph $y = \dfrac{1}{|f(x)|}$



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Part II – calculator is allowed >> Questions 7-9

7. Consider the functions $f(x)=\frac{2x+3}{x-4}$ and $g(x)=\frac{x-1}{x+1}$.

(a) State the domain and range for $f(x)$. **[2 marks]**

(b) If $(c, 0)$ is the x-intercept for the graph of $f(x)$, then find the value of c. **[2 marks]**

(c) (i) Find $f^{-1}(x)$. **[3 marks]**

(ii) Why must $(0, c)$ be the y-intercept for the graph of $f^{-1}(x)$? **[2 marks]**

(d) Find the value of $g(f(3))$. **[2 marks]**

(e) Find an expression for $g(f(x))$. **[2 marks]**

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8. Let $f(x)=\frac{4-x^2}{4-\sqrt{x}}$.

(a) State the largest possible domain for f. **[2 marks]**

(b) Solve the inequality $f(x) \geq 1$. *show work/method* **[4 marks]**

9. State the domain and range for each function.

(a) $f(x)=\frac{1}{x^2-9}$ **[3 marks]**

(b) $g(x)=\ln(x+4)$ **[3 marks]**