# Mock Test 2
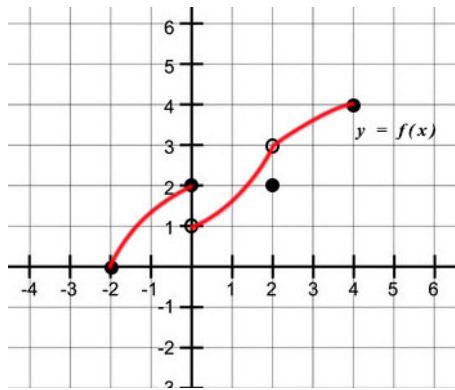
**Part A: Knowledge and Understanding  (24 marks)**

1) Evaluate each limit  (3 marks each)

a) $\lim\limits_{x\to4}\frac{4-\sqrt{12+x}}{x-4}$  b) $\lim\limits_{x\to4}\frac{\sqrt{8-x}-2}{1-\sqrt{5-x}}$  c) $\lim\limits_{h\to0}\frac{\frac{1}{x+h}-\frac{1}{x}}{h}$  d) $\lim\limits_{x\to0}\frac{(x+216)^{\frac13}-6}{x}$

2) Using the graph of the function f(x) below, determine each of the following :
(8 marks)



a)  $\lim\limits_{x\to2^{+}} f(x)$        b) $f(2)$        c) $f(0)$

d)  $\lim\limits_{x\to-2^{+}} f(x)$        e) $\lim\limits_{x\to2} f(x)$        f)  $\lim\limits_{x\to4^{-}} f(x)$

3) Find the slope of the tangent to the curve $y=\frac{x}{x^2-3}$ at x = 2.  (4 marks)

**Part B: Application (13 marks)**

1) Determine the equation of the tangent to $f(x)=\sqrt{x+2}$ when x =− 1.  (4 marks)

2) Find the equation of the line that passes through (2,2) and is parallel to the line tangent to $f(x)=-3x^3-2x$ at (− 1,5).   (4 marks)

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3) Sketch any function that satisfies the following conditions : (5 marks)

$$f(2) = 4, \quad \lim_{x \to 2^-} f(x) = 7, \quad \lim_{x \to 2^+} f(x) = -5 \quad f(x) \text{ decreases when } x > 2$$

## Part C: Communication (12 marks)

1) Explain why the function $f(x) = \frac{2x^2+7x+3}{x^2-9}$ is discontinuous at $x = -3$. (3 marks)

2) Suppose the $\lim_{x \to a} f(x)$ exists at point a. Does this condition guarantee that the

function $f(x)$ is continuous at $x = a$? Illustrate your explanation with an example. (3 marks)

3) What do the following indicate about the graph of $f(x)$? Explain. (2 marks each)

   a) $\frac{f(2+3)-f(2)}{3} = 7$

   b) $\lim_{h \to 0} \frac{f(2+h)-f(2)}{h} = 9$

## Part D: Thinking (10 marks)

1) Find the coordinates of the point where the tangent to $f(x) = x^3 + 3x$ is perpendicular
to the line $x + 3y - 12 = 0$. (6 marks)

2) Determine the values of a and b so that the function $f(x)$ is continuous. (4 marks)

$$f(x) = \begin{cases} ax + b & x < -2 \\ x^2 + 2ax - b & -2 \le x < -1 \\ 4 & x \ge -1 \end{cases}$$