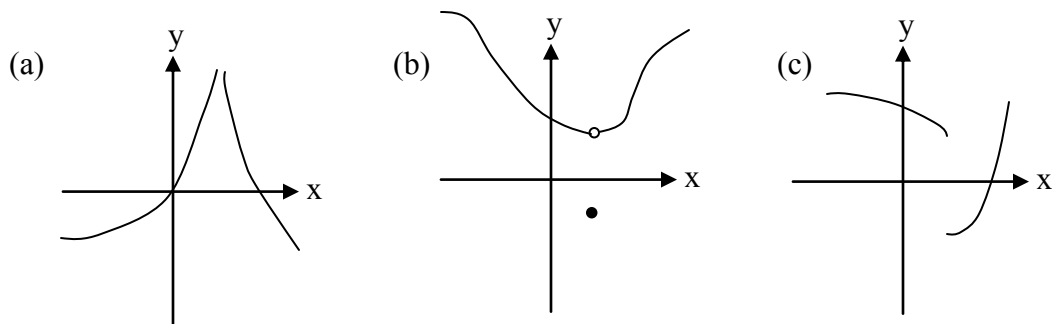# MATH 1500 Assignment 2

(Follows Unit 7 in the manual)

Values

[6] 1. Each of the following graphs contains a discontinuity. Determine whether the discontinuity is (i) a removable discontinuity (ii) a jump discontinuity or (iii) an infinite discontinuity [cf. Section 2.5]

[6] 2. Each of the following functions contains a discontinuity at $x = 3$. Determine whether the discontinuity at $x = 3$ is (i) a removable discontinuity (ii) a jump discontinuity or (iii) an infinite discontinuity [cf. Section 2.5]

(a) $f(x) = \dfrac{x^2 + 9}{x - 3}$ (b) $f(x) = \dfrac{x^2 - 9}{x - 3}$

[5] 3. Show that the function $f(x) = x^3 - 15x + 1$ has three zeros in the interval $[-4, 4]$. [cf. Section 2.5]

[4] 4. Consider the function $f(x) = \begin{cases} x^2 & \text{if } x \le 2 \\ k - x^2 & \text{if } x > 2 \end{cases}$. For what value of k will this function be continuous at $x = 2$?   [cf. Section 2.5]

[8] 5. Evaluate the following limits.

(a) $\displaystyle\lim_{x \to \infty} \dfrac{1}{\sqrt{x^2 - 2x} - x}$ (b) $\displaystyle\lim_{x \to \infty}\left(\sqrt{x^2 + x} - x\right)$ [cf. Section 2.6]

[9] 6. Find the horizontal and vertical asymptotes of $f(x) = \dfrac{\sqrt{9x^2 + x}}{2x+1}$.

[cf. Section 2.6]

[6] 7. Find an equation of the tangent line to the curve $y = \sqrt{x+3}$ at the point (1, 2).

[cf. Sections 2.7 and 2.8]

[6] 8. Use the definition of the derivative to find the derivative of $f(x) = \dfrac{2-x}{2+x}$.

[cf. Sections 2.8 and 2.9]

[15] 9. Find the derivatives of the following functions. Do <u>not</u> use the definition of the derivative. You need not simplify your answers.

[cf. Sections 3.1, 3.2 and 3.4]

(a) $f(x) = 4x^{2/3} - 5\sqrt{x} + e^x + \pi^3$

(b) $f(x) = (3x^4 + e^{-x})(x^{1/3} + 3\sin x)$

(c) $f(x) = \dfrac{6x^{2/3} + 2\tan x}{2x^3 - 4x}$

[5] 10. Evaluate $\displaystyle\lim_{x \to 0} \dfrac{\sin(2x)}{\tan x}$. [cf. Section 3.4]

Total = 70