Name: _____ Score: ___ / 55

3CD MAS Test – May 2010
Calculator Free

1. [4 marks]

4m

Solve $|2x + 3| > |x - 1|$, showing full reasoning.

2. [3 marks]

3m

Determine the exact value of $\lim_{h \to 0}\left(\frac{\cos 2(a+h) - \cos 2a}{h}\right)$, where a is a constant.

6m **3. [6 marks]**

The equation of one of the tangents to the curve $xy(x + y) - 12 = 0$ at the points where $x = 1$ is $y = -\frac{15x}{7} + \frac{36}{7}$.

Determine the equation of the other tangent to the curve when $x = 1$.

4. [10 marks]

For each of the following functions, find $\frac{dy}{dx}$.

3m (a) $y = \frac{x^3}{\cos x}$ $\frac{dy}{dx}$

[3]

4m (b) $y = (\sin x)^x$

[4]

3m (c) $y = \frac{t+2}{t}$ and $x = \frac{t-2}{2}$, giving your answer in terms of x.

[3]

Σ 10m

5. [6 marks]

6m

The volume of a cylinder is constant at 50π cm^3, but both the height and the radius are changing. Determine the rate at which the radius is changing at the instant when the height is decreasing at a rate of 3 cm/sec and the radius is 5 cm.

Σ 6m

6. [9 marks]

Consider the function $y = |1 - 2x| + |x|$.

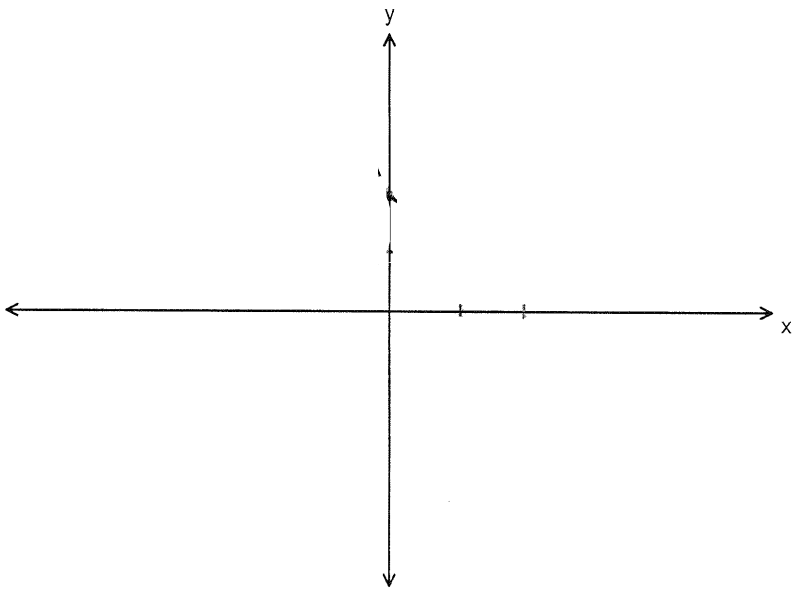
(a) Rewrite the function in piecewise form.

3m

[3]

3m

(b) Sketch a graph of the function on the axes provided.



[3]

(c) Hence, differentiate the function with respect to x.

3m

[3]

Σ 9m

4m

7. [4 marks]

Determine the following limit, showing full reasoning.

$$\lim_{x \to 0} \left(\frac{\tan^2 x}{1 - \cos x} \right)$$

3m

8. [3 marks]

Explain clearly how you would determine the following derivative.
(It is not necessary to work out the answer.)

$$\frac{d}{d\left(\sqrt{x}\right)} \ln\left[\frac{2\sqrt{x}}{1-\sqrt{x}}\right]$$

Σ 7m

9. **[10 marks]**

Given matrices $\mathbf{A} = \begin{bmatrix} 4 & 3 \\ 2 & -1 \end{bmatrix}$, $\mathbf{B} = \begin{bmatrix} x & 0 \\ 0 & -1 \end{bmatrix}$, $\mathbf{C} = \begin{bmatrix} 8 & -3 \\ 5 & 1 \end{bmatrix}$ and $\mathbf{D} = \begin{bmatrix} 2 \\ y \end{bmatrix}$,

(a) Determine $\mathbf{A} + \mathbf{D}$.

2m

[2]

(b) If $\mathbf{AB} = \mathbf{C}$, then determine the value of x.

4m

[4]

(c) If $\mathbf{A} + 2\mathbf{B} = \begin{bmatrix} 8 & 3 \\ 2 & -3 \end{bmatrix}$, then determine the value of x.

2m

[2]

(d) If $x = 2\sqrt{2}$, then determine $\mathbf{B}^2$.

2m

[2]

END OF TEST

Σ 10m