

Please box in your final answers when possible. A correct answer with no relevant work may receive no credit while an incorrect answer with some correct work may receive partial credit. Books, notes, crib sheets, and calculators are NOT permitted.

1. Solve the following:

a)  $\sqrt{2} \cos^2 x + 3 \cos x = 0$

b)  $|4x - 3| > 7$

2. Find the following limits:

a)  $\lim_{x \rightarrow 0} \frac{\sin 7x}{4x}$

b)  $\lim_{x \rightarrow 4} \frac{x^2 - 3x - 4}{x - 4}$

c)  $\lim_{h \rightarrow 0} \frac{\sin(x+h) - \sin x}{h}$

3. Find the following derivatives, but do not simplify:

a)  $y = \tan(\cos(x^3 - 4x))$

b)  $y = \sin^4[2 - 5t]$

c)  $x^3 y^2 - \tan y = 4x^2$

d)  $y = x^4 \sin^2 3x$

4a) Write the definition of a derivative

b) Use the definition to find the derivative of  $y = x^2 + 2x$

5. Given the following graph of  $f(x)$ ,

make a first and second derivative chart.

6. Given the function:  $y = x^{\frac{5}{3}} - 5x^{\frac{2}{3}}$      $y' = \frac{5(x-2)}{x^{\frac{1}{3}}}$      $y'' = \frac{10(x+1)}{9x^{\frac{4}{3}}}$

Give the following:

- first derivative chart
- extrema
- second derivative chart
- inflection points
- draw an accurate sketch of the graph labeling the critical points
- on the interval  $[-1, 5]$  are there any absolute max or mins? If so, find them.

The following are points on the graph –only use those that are critical points in sketching the graph:  $(-1, -6)$ ,  $(-8, -62)$   $(0, 0)$   $(1, -4)$   $(2, -4.8)$   $(5, 0)$

7. a) State the three conditions necessary for a function to be continuous at  $x = a$ .

- Are there numbers  $a$  and  $b$  that will make the function  $f(x)$  differentiable at  $x=1$ ?  
If so, state their values.

$$f(x) = \begin{matrix} 5ax + b \\ 5ax^2 - 5x + 2b \end{matrix}$$