CONSOLIDATION OF BASIC DERIVATIVES

1. Find the derivative function for each of the following:

a) $y = 3x + 9$
b) $y = 100$
c) $y = -3x^2 + 7x - 9$
d) $y = 5^x$

e) $y = 2(5)^x$
f) $y = -5x^5 - 7x^3$
g) $y = 2\sin x$
h) $y = \frac{1}{4}\cos x$

i) $y = e^x$
j) $y = -4e^x$
k) $y = (5x-2)^2$
l) $y = (x+3)^3$

m) $y = \ln x$
n) $y = 9\ln x$
o) $y = \ln(x^3)$
p) $y = 4x - 7$

q) $y = -9$
r) $y = 3x^2 - 2x + 9$
s) $y = 5^x$
t) $y = 3(2)^x$

u) $y = 6x^6 - 3x^2$
v) $y = 4\sin x$
w) $y = -\frac{1}{2}\cos x$

3. Given $f(x)$ is a polynomial function of degree 6, what can you tell me about the derivative of the function?

4. Given $f(x)$ is an exponential function, what can you tell me about the derivative of the function?

5. What does $\lim\limits_{h \to 0} \dfrac{2(x+h)^3 - 2x^3}{h}$ represent?

6. Sketch the graph of a function that satisfies each set conditions:

Graph 1	Graph 2
➤ $f(0) = 0$ ➤ $f'(x) > 0$, when $x < -2$ and when $-2 < x$ ➤ $\lim\limits_{x \to -2^+} f(x) = -\infty$ and $\lim\limits_{x \to -2^-} f(x) = \infty$ ➤ $f(-2) =$ undefined and $f'(-2) =$ undefined ➤ H.A. is $y = 2$ as $x \to \infty$ and H.A. is $y = 2$ as $x \to -\infty$ Are there other possible graphs?	➤ $f(2) = 3$, $f(5) = 6$ ➤ $f'(2) = f'(5) = 0$ ➤ $f'(x) < 0$, $x < 2 \ \cup \ x > 5$ ➤ $f'(x) > 0$, $2 < x < 5$ Are there other possible graphs?

7. A rested student is able to memorize M words after t minutes, where $M = 0.1t^2 - 0.001t^3$. During which period of time is the student's ability to memorize increasing?

8. Express as a single natural logarithm:

a) $\ln 50 - \ln 2$
b) $\ln 3 + \ln 9$
c) $2\ln 4 - 3\ln 6$
d) $5\ln 2 + \frac{1}{2}\ln 7$
e) $2\ln(4x) - \frac{1}{2}\ln(36\sqrt{x})$

f) $\ln(x-3) + 2\ln(x-3)$
g) $3\ln(3x) + \ln x - 2\ln 3$
h) $\ln x - \frac{1}{3}\ln y + 2\ln z$

9. Evaluate (without technology):

a) $\ln e$
b) $e^{\ln 5}$
c) $\ln e^{2x}$
d) $\ln\left(\frac{1}{e^3}\right)$
e) $\ln\left(e^{2\ln e}\right)$
f) $-2e^{\ln 3}$
g) $e^{-\ln(\ln e)}$
h) $\ln(\ln 1)$

11. Find the equation of the tangent line of $f(x) = 5^x$ at $x = 3$.

12. From the fact that at the vertex for a parabola the slope of the tangent line is zero, find the vertex of $y = -5x^2 + 2x + 1$

13. Determine the equation of the tangent line of $f(x) = \cos x$ at $x = \dfrac{5\pi}{6}$. Use exact values only.

14 Determine the equation of the tangent line of $f(x) = 4\sin x$ at $x = \dfrac{\pi}{4}$. Use exact values only.

15. Determine the instantaneous rate of change of $f(x) = e^x$ at $x = 2$.

16. Determine the equation of the tangent line of $f(x) = \ln x^4$ at $x = -3e$. Use exact values only.

17. Determine the point, on the function $f(x) = 2x^2 - 7x + 9$, at which the slope of the tangent line is 1.

18. Find the second degree polynomial which passes through the point $(2, -1)$ and whose tangent line has a slope of 0 at $x = 1$ and a slope of -4 at $x = -1$.

19. Find each of the following:

a) Find the average rate of change for $y = 3x^2 - 4$ from $x = \dfrac{1}{2}$ to $x = 2$.

c) Find the equation of the tangent to $y = \cos x$ at $x = \dfrac{3\pi}{2}$.

d) Find the equation of the tangent for $y = 2^x$ at the point $P\left(\dfrac{-1}{4}, \dfrac{1}{\sqrt[4]{2}}\right)$.

e) Find the instantaneous rate of change for $y = 3e^x$ at the point $Q(2, 3e^2)$.

f) Find the slope of the tangent to the curve $y = 3\sin x$ at $x = \dfrac{7\pi}{6}$.

g) Find the equation of the tangent to $y = 5\ln x$ at $x = e$.