# Morning AI (A) - Homework

## IMPLICIT DERIVATIVE

1. $x^3 + 4y^3 = 1$
2. $x^2 + xy - y^2 = 4$
3. $y \cos x = x^2 + y^2$
4. $x^4(x + y) = y^2(3x - y)$
5. $\tan^{-1}(x^2 \cdot y^2) = x + xy^2$
6. $e^{(x/y)} = x - y$

## EQUATION OF THE TANGENT LINE AND NORMAL LINE TO THE CURVE

1. $y \sin 2x = x \cos 2y$ at $(\pi/2 , \pi/4)$
2. $x^2 + xy + y^2 = 3$ at $(1 , 1)$
3. $x^2 + y^2 = (2x^2 + 2y^2 - x)^2$ at $(0,1/2)$
4. $2(x^2 + y^2) = 25(x^2 - y^2)$ at $(3 , 1)$

## ABSOLUTE MAXIMUM AND MINIMUM

1. $f(x) = 2x^3 - 3x^2 - 12x + 1$ Interval: $[-2 , 3]$
2. $f(x) = 3x^4 - 4x^3 - 12x^2 + 1$ Interval: $[-2 , 3]$
3. $f(x) = x + 1/x$ Interval: $[0.2 , 4]$
4. $f(t) = t\sqrt{(4 - t^2)}$ Interval: $[-1 , 2]$
5. $f(t) = 2 \cos t + \sin 2t$ Interval: $[0 , \pi/2]$
6. $f(x) = x e^{(-x^2/8)}$ Interval: $[-1 , 4]$
7. $f(x) = \ln(x^2 + x + 1)$ Interval: $[-1 , 1]$

## RELATIVE EXTREMAS

1. $f(x) = 4 + (1/3)x - (1/2)x^2$
2. $f(x) = 2x^3 - 3x^2 - 36x$
3. $g(t) = t^4 + t^3 + t^2 + 1$
4. $g(y) = (y - 1) / (y^2 - 4 + 1)$
5. $h(t) = t^{(3/4)} + 2t^{(1/4)}$
6. $f(x) = x^{(4/5)} (x - 4)^2$
7. $f(\theta) = 2\cos\theta + \sin^2\theta$
8. $f(x) = x^2 e^{(-3x)}$

# Mean Value Theorem

**1) Roll's Theorem**

i ) $f(x) = x^2 - 3x + 2$ on [1,2]

ii) $f(x) = \sin^2 * x$ on $[0,x]$

$f(x) = x^2 - 7x + 12$ on [3,4]

iv) $f(x) = x^2 + 2x - 1$ on [0,1]

v) $f(x)=|x|$, on [-1,1]

vi) $f(x) = x^2 - 2x$, on [0,2]

vii) $f(x) = \cos x$, $[0,25\pi]$

(vii) $f(x) = x^3 - 3x$ , on $[-\sqrt{3}-\sqrt{3}]$

**2) Lagrange's Mean Value Theorem (LMVT)**

- $f(x) = x^3 - 3x - 1$ , $[-(11/7), 13/7]$
- $f(x) = 2x^2 - 3x + 1$ , [0,2]
- $f(x) = x^3 - 3x + 2$ , [-2,2]
- $f(x) = \ln x$ , [1,4]
- $f(x) = 1/x$ , [1,3]

**3) Cauchy Mean Value Theorem (CMVT)**

- If $f(x)=e^x$ and $g(x)=e^{2x}$ on [o, ln2], C= ? by Cauchy theorem?
- $f(x) = x^2$, $g(x) = x^3$ on [1,2] C=? by Cauchy theorem.

## POWER SERIES

**Find Maclaurin Series for:**

1) $f(x) = e^{`x}$
2) $f(x) = \ln(1 + x)$
3) $f(x) = \ln(1 - x)$
4) $f(x) = \cos x$
5) $f(x) = \sin x$

**Find Taylor Series for:**

1) $\sin x$ at $x = \pi/2$
2) $f(x) = 1/\sqrt{x}$ at $x = 9$