**TO UNDERSTAND THE** **2ND DERIVATIVE TEST.**

  **y**

***y = x(x – 3)2 MAX***

 ***INFL***

 ***= x3 – 6x2 + 9x***

(cubic curve) MIN

 1 2 3 4

 **y ′**

***y ′ = 3x2 – 12x + 9***

 ***= 3(x2 – 4x + 3)***

 ***= 3(x – 1)(x – 3)*** 1 2 3 4

(parabola)

 ***y ′′***

***y ′′ = 6x – 12***

**y ′′ > 0**

*(line graph)*

1 2 3 4

**y ′′ = 0**

**y ′′< 0**

**When the cubic has a MAXIMUM the 2nd derivative is a NEGATIVE number.**

**When the cubic has a MINIMUM the 2nd derivative is a POSITIVE number.**

**When the cubic has an INFLECTION point the 2nd derivative is ZERO.**

Consider the curve *y = x2(6 – x ) = 6x2 – x3*

 *dy = 12x – 3x2*

 *dx*

 *= 3x(4 – x) = 0* at max/min

 So *x = 0 or 4*

 ***d2y = 12 – 6x***

 ***dx2***

**2nd derivative test : (to determine which is a MAX and which is a MIN)**

At *x = 0* ***d2y = +12*** so MIN point At *x = 4* ***d2y = –12*** so MAX point

***dx2******dx2***

 y

 (4, 32)

 1 2 3 4 5 6

Point of inflection is when *d2y = 0*

 *dx2*

 so *12 – 6x = 0*

 *x = 2*