WORKSHEET VII

SHORTCUTS

I   Using the short cuts of differentiation *when appropriate*, compute the derivative of each of the following functions.

(A) $y = 2015 + 3x - \pi x^4 + e^4$

(B) $y = x \sin x$

(C) $y = \dfrac{x+3}{x+7}$

(D) $y = \dfrac{x}{\sin x}$

(E) $y = \dfrac{\cos x}{x^3 + 9}$

(F) $y = (x^2 + 4x - 1)(x^3 + 5x^4 - x^3 + x^2 + 3x + 13)$

(G) $y = \sin^2 x$

(H) $y = (x^2 + 5x + 1)^2$

II (A) Find the equations of the *tangent* and *normal lines* to the curve

$$y = (x - 4)/(x + 1) \text{ at } x = 3.$$

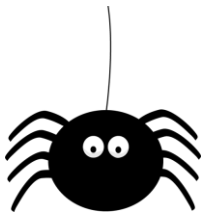(B) Find the equations of the *tangent* and *normal* lines to the curve

$$y = \sin x \text{ at } x = \pi/4.$$

III (A) Using appropriate shortcuts, find formulas for the derivatives of

$$y = \tan x \text{ and } y = \sec x.$$

(B) Using appropriate shortcuts, find formulas for the derivatives of

$$y = \sinh x, y = \cosh x \text{ and } y = \tanh x.$$

IV   Charlotte, the spider, dances along the x-axis according to the rule

$x(t) = t^3 - 3t + 5$. (Here time is measured in *seconds* and distance in *cm*.)

(A) Find Charlotte's velocity at time $t = 2$ sec.

(B) Find Charlotte's acceleration at time $t = 2$ sec.

V Sketch the curve $y = x^2(x - 2)^2$. Over which interval(s) is the graph *rising? falling?*
Locate any local maxima or minima.

VI Sketch the curve $y = (x^2 + 1)/(x^2 + 3)$. Over which interval(s) is the graph rising?
falling? Locate any local maxima or minima.

VII   Sketch the curve $y = xe^x$. Over which interval(s) is the graph rising? falling? Locate any local maxima or minima.

VIII   Sketch the curve $y = (x - 3)/(x^2 + 1)$. Over which interval(s) is the graph rising? falling? Locate any local maxima or minima.

IX   Consider the curve $y = b + c \sin x$. For each of the following values of b and c, determine when the graph is rising and when it is falling:

    (A) $b = 3, c = 1$

    (B) $b = c = 1$

    (C) $b = 1, c = 2$

X   Sketch the curve $y = 1/x + x^2$ over the interval $(0, \infty)$. Over which interval(s) is the graph rising? falling? Locate any local maxima or minima.

What Romantic terminology called genius or talent or inspiration is
nothing other than finding the right road empirically, following one's
nose, taking shortcuts.

       - Italo Calvino (1923 – 1985)