10. (Cont.)

⑦ INC/ DEC

$$y = \underbrace{x^3}_{P} \underbrace{e^{-x}}_{Q}$$

$$P' = 3x^2 \qquad Q' = e^{-x} \cdot \frac{d}{dx}(-x)$$

$$Q' = -e^{-x}$$

$$P'Q + PQ'$$

* $y' = 3x^2 e^{-x} + x^3 \cdot (-e^{-x})$

$$y' = x^2 e^{-x}(3-x)$$

$$x^2 e^{-x}(3-x) = 0$$

$$x^2 = 0 \qquad \cancel{e^{-x}=0} \qquad 3-x=0$$

$$x = 0 \qquad\qquad\qquad x = 3$$

Number line: $-\infty$ ——— $x=0$ ——— $x=3$ ——— ∞

$x=-1$	$x=1$	$x=4$	TEST CASES
$x^2 e^{-x}(3-x)$			PLUG INTO
$(+)(+)(3-(-1))$	$(+)(+)(3-1)$	$(+)(+)(3-4)$	OUR y'
↗	↗ REL MAX	↘	

$$e^{-x} = \frac{1}{e^x}$$

INC $(-\infty, 0)$
INC $(0, 3)$
DEC $(3, \infty)$

⑧ RELATIVE EXTREMA

REL. MAX : $\left(3, \dfrac{27}{e^3}\right)$

$(3, 1.3)$

$\underline{x=3}$

$f(x) = x^3 e^{-x}$

$= 3^3 e^{-3}$

$= 27 e^{-3}$

$= \dfrac{27}{e^3}$