Quiz 3

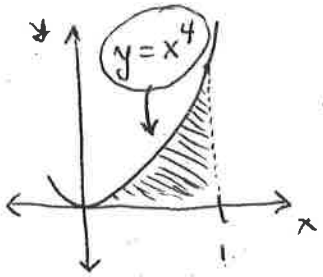
Name: key Row: _____

[4] **1.** Give a definition of the number e.

$$e = \lim_{h \to 0} (1+h)^{\frac{1}{h}}$$ (2) (2)

(other correct definitions are also OK.)

[8] **2.** Find the volume of the solid obtained by revolving the shaded region about the x-axis. Show all work.



$$V = \int_0^1 \pi y^2 \, dx$$ (2) (volume by discs)

$$= \int_0^1 \pi (x^4)^2 \, dx$$ (2)

$$= \int_0^1 \pi x^8 \, dx$$ (2)

$$= \left[\frac{\pi x^9}{9} \right]_0^1 = \frac{\pi}{9}(1^9 - 0^9) = \boxed{\frac{\pi}{9}}$$ (2)

[8] **3.** Find the derivative of the function $y = xe^{\sqrt{x}}$. Show all work.

$$\frac{dy}{dx} = \frac{d}{dx}(x) \cdot e^{\sqrt{x}} + x \cdot \frac{d}{dx}\left(e^{\sqrt{x}}\right)$$ (2) (product rule)

$$= (1) \cdot 1 \cdot e^{\sqrt{x}} + x \cdot \frac{d}{dx}\left(e^{(x^{\frac{1}{2}})}\right)$$ (1)

$$= e^{\sqrt{x}} + x \cdot e^{(x^{1/2})} \frac{d}{dx}\left(x^{\frac{1}{2}}\right)$$ (2) (chain rule)

$$= \boxed{e^{\sqrt{x}} + x \cdot e^{(x^{1/2})} \cdot \tfrac{1}{2} x^{-\frac{1}{2}}}$$ (2)

(or: $\frac{dy}{dx} = e^{\sqrt{x}} + x \cdot e^{\sqrt{x}} \frac{1}{2\sqrt{x}} = e^{\sqrt{x}}\left(1 + \frac{\sqrt{x}}{2}\right)$.)