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Quiz 0 MAP 2302 - Summer B 2018

To receive credit you MUST SHOW ALL YOUR WORK. Answers which are not supported by work will not be considered.

1. (4 pts) Compute $\frac{dy}{dx}$ in each case:

(a) $y = x^2 \ln x$

By product rule

$$\frac{dy}{dx} = 2x\ln x + x^2 \cdot \frac{1}{x}$$

$$\frac{dy}{dx} = 2x\ln x + x$$

(b) $y = \sin^2(\sqrt{x}) = \left(\sin(\sqrt{x})\right)^2$

Chain Rule

$$\frac{dy}{dx} = 2\sin(\sqrt{x}) \cdot \cos(\sqrt{x}) \cdot \frac{1}{2} x^{-\frac{1}{2}}$$

$$\frac{dy}{dx} = \frac{\sin(\sqrt{x})\cos(\sqrt{x})}{\sqrt{x}}$$

2. (4 pts) Compute each anti-derivative:

(a) $\int e^{\tan x} \sec^2 x \, dx =$

sub. $w = \tan x$

$dw = \sec^2 x \, dx$

$$= \int e^w dw = e^w + C$$

$$= e^{\tan x} + C$$

(b) $\int \frac{x+1}{x^2+1} dx = \int \frac{x}{x^2+1} dx + \int \frac{1}{x^2+1} dx =$

sub. $w = x^2+1$ → ↓

$dw = 2x\,dx$

$\frac{1}{2}dw = x\,dx$

$$= \frac{1}{2}\ln(x^2+1) + \arctan x + C$$

3. (3 pts) Newton's Law of Cooling states that the rate of change of the temperature of a cooling body is proportional to the difference between the temperature of the body and the constant temperature of the surrounding medium. A potato that has been baking at 400°F is taken out of the oven and is left to cool down in a room with (constant) temperature of 70°F. Let $y(t)$ be the temperature of the potato t minutes after it was taken out of the oven. Set up a differential equation for $y(t)$ according to Newton's Law of Cooling. You do not have to solve the equation.

$$\frac{dy}{dt} = k(y - 70)$$

k constant, $k < 0$.

$$y(0) = 400$$

← note: just this was enough for full credit