Name Key

Unit 8 Practice

1. Find the limit using L'Hopital's Rule:

a) $\lim_{x \to 0} \frac{3\sin 2x}{2x}$ $\boxed{3}$

b) $\lim_{x \to \pi} \frac{1-\cos 2x}{x^2-\pi^2}$ $\boxed{0}$

2. Find $f'(x)$.

a) $f(x) = \tan^{-1}\sqrt{x}$

$f'(x) = \frac{1}{2\sqrt{x}(1+x)}$

b) $f(x) = \sec^{-1}(3x^2)$

$f'(x) = \frac{2}{x\sqrt{9x^4-1}}$

3. Integrate each.

$\int \frac{dx}{16+81x^2} = \frac{1}{36}\tan^{-1}\left(\frac{9x}{4}\right) + C$

$\int \frac{x^2}{\sqrt{4-x^6}}dx = \frac{1}{3}\sin^{-1}\left(\frac{x^3}{2}\right) + C$

4. The velocity of a particle over $0 \le t \le 30$ seconds is shown in the table. Using a **midpoint** Riemann sum with 5 rectangles, find the approximate value of $\int_0^{30} v(t)dt$.

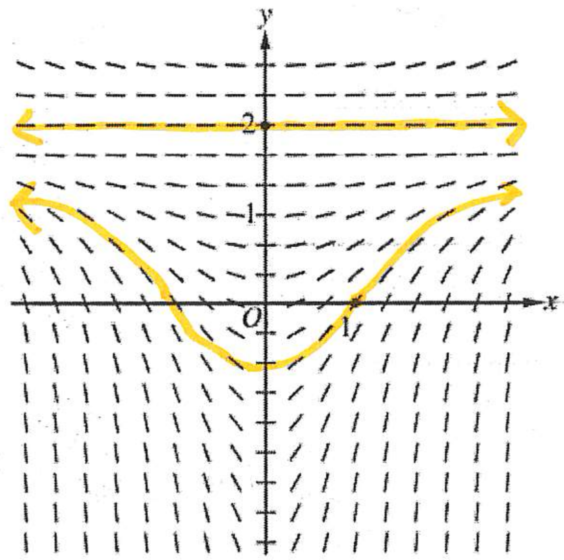
t	0	3	6	9	12	15	18	21	24	27	30
v(t)	0	7.5	10.1	12	13	13.5	14.1	14	13.9	13	12.2

$\boxed{360}$

Name 2018, #6

Consider the differential equation $\frac{dy}{dx} = \frac{1}{3}x(y-2)^2$.

(a) A slope field for the given differential equation is shown below. Sketch the solution curve that passes through the point $(0, 2)$, and sketch the solution curve that passes through the point $(1, 0)$.



(b) Let $y = f(x)$ be the particular solution to the given differential equation with initial condition $f(1) = 0$. Write an equation for the line tangent to the graph of $y = f(x)$ at $x = 1$. Use your equation to approximate $f(0.7)$.

$y = \frac{4}{3}(x-1)$

$f(.7) \approx -.4$

(c) Find the particular solution $y = f(x)$ to the given differential equation with initial condition $f(1) = 0$.

$y = \frac{-6}{x^2+2} + 2$