How do you sound out your name? Key

AP Calculus AB: 8.4 FTC U-sub intervals

1. $\int_{-1}^{0} 18(2x+3)^2\, dx$

$u = 2x+3$
$du = 2\, dx$
$dx = \frac{du}{2}$

$\int_1^3 18u^2 \frac{du}{2}$

$\int_1^3 9u^2\, du = \left[\frac{9u^3}{3}\right]_1^3 = \left[3u^3\right]_1^3$

$3(3)^3 - 3(1)^3 = 81 - 3 = \boxed{78}$

2. $\int_0^1 x \cdot e^{5x^2}\, dx$

$u = 5x^2$
$du = 10x\, dx$
$dx = \frac{du}{10x}$

$\int_0^5 \cancel{x} e^u \frac{du}{10\cancel{x}}$

$\int_0^5 \frac{e^u}{10} du = \left[\frac{e^u}{10}\right]_0^5 = \frac{e^5}{10} - \frac{e^0}{10} = \boxed{\frac{e^5 - 1}{10}}$

3. $\int_{\pi}^{3\pi} \sin\left(\frac{x}{6}\right) dx$

$u = \frac{x}{6}$
$du = \frac{1}{6} dx$
$dx = 6\, du$

$\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} \sin(u)\, 6du$

$6\left[-\cos(u)\right]_{\frac{\pi}{6}}^{\pi/2} = 6\left[-\cos\left(\frac{\pi}{2}\right) - -\cos\left(\frac{\pi}{6}\right)\right]$

$= 6\left[-\frac{\sqrt{0}}{2} + \frac{\sqrt{3}}{2}\right] = \frac{6\sqrt{3}}{2} = \boxed{3\sqrt{3}}$

4. $\int_{-2}^{3} \frac{4x}{x^2-3} dx$

$u = x^2 - 3$
$du = 2x\, dx$
$dx = \frac{du}{2x}$

$\int_1^6 \frac{\cancel{4x}^{2}}{u} \frac{du}{\cancel{2x}}$

$= \int_1^6 \frac{2}{u} du = \left[2\ln|u|\right]_1^6$

$2\ln|6| - 2\ln|1| = 2\ln|6| = \boxed{\ln|36|}$

5. Calculator problem: Find $g(4)$ of the function $g(x) = \frac{x^2}{\ln(x)}$ if $g(2) = 3$

$3 + \int_2^4 g(x)\, dx = \boxed{19.681}$

6. A car's velocity is given by the function $v(t) = 3x^2 + 4x - 5$. If at t=0 the car's position is 3 meters.

(a) Find the position of the car after the first 2 seconds.

$3 + \int_0^2 v(t)\, dt = 3 + \left[\frac{3x^3}{3} + \frac{4x^2}{2} - 5x\right]_0^2 = \boxed{9m}$

(b) Find the function for acceleration.

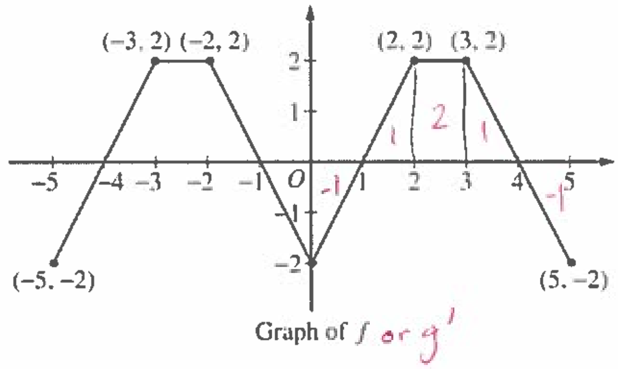
$\boxed{v'(t) = 6x + 4}$

(c) Is the car speeding up or slowing down at time t=1?

$v(1) = 3(1)^2 + 4(1) - 5 = +$
$a(1) = 6(1) + 4 = +$

speeding up because $v(1)$ & $a(1)$ are both positive.

Place your name in the blank:________________________________



3. The graph of the function f shown above consists of six line segments. Let g be the function given by $g(x) = \int_0^x f(t)\,dt$.

(a) Find $g(4)$, $g'(4)$, and $g''(4)$.

(b) Does g have a relative minimum, a relative maximum, or neither at $x = 1$? Justify your answer.

(c) Suppose that f is defined for all real numbers x and is periodic with a period of length 5. The graph above shows two periods of f. Given that $g(5) = 2$, find $g(10)$ and write an equation for the line tangent to the graph of g at $x = 108$.

a) $g(4) = \int_0^4 f(t)\,dt = 2$

$g'(4) = f(4) = 0$

$g''(4) = f'(4) = -2$

b) at $x=1$ $g(x)$ has a minimum value since the graph of f changes from negative to positive values.

c) $g(10) = 2 + \int_5^{10} f(t)\,dt = 2 + 2 = \boxed{4}$

$y - y_1 = m(x - x_1)$

$y - 44 = \text{und}(x - 108)$

the slope is undefined at $x = 108$ therefore there is no equation for a tangent line.