1. $\int \left(5e^{2x} + \frac{1}{x}\right) dx =$

(A) $\frac{5}{2}e^{2x} + \frac{2}{x^2} + C$

(B) $\frac{5}{2}e^{2x} + \ln|x| + C$

(C) $5e^{2x} + \frac{2}{x^2} + C$

(D) $5e^{2x} + \ln|x| + C$

(E) $10e^{2x} - \frac{1}{x^2} + C$

$$\int e^{ax+b}\,dx = \frac{1}{a}e^{ax+b} + c$$

$$\frac{5}{2}e^{2x} + \ln|x| + C$$

2. If $f(x) = \sqrt{x} + \frac{3}{\sqrt{x}}$, then $f'(4) =$

(A) $\frac{1}{16}$ (B) $\frac{5}{16}$ (C) 1 (D) $\frac{7}{2}$ (E) $\frac{49}{4}$

$$f'(x) = \frac{1}{2\sqrt{x}} - \frac{3}{2\sqrt{x^3}}$$

$$f'(4) = \frac{1}{4} - \frac{3}{16} = \frac{1}{16}$$

$$3x^{-1/2} \longrightarrow -\frac{3}{2}x^{-3/2}$$

3. $\int x^2\left(x^3+5\right)^6 dx =$

(A) $\frac{1}{3}\left(x^3+5\right)^6+C$

(B) $\frac{1}{3}x^3\left(\frac{1}{4}x^4+5x\right)^6+C$

(C) $\frac{1}{7}\left(x^3+5\right)^7+C$

(D) $\frac{3}{7}x^2\left(x^3+5\right)^7+C$

(E) $\frac{1}{21}\left(x^3+5\right)^7+C$

$u = x^3+5$

$du = 3x^2\,dx$

$\frac{1}{3}du = x^2\,dx$

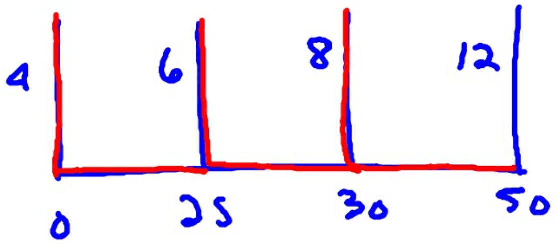
$\frac{1}{3}\int u^6\,du = \frac{1}{3}\frac{1}{7}u^7+C$

$=$

x	0	25	30	50
$f(x)$	4	6	8	12

4. The values of a continuous function f for selected values of x are given in the table above. What is the value of the left Riemann sum approximation to $\int_0^{50} f(x)\,dx$ using the subintervals $[0, 25]$, $[25, 30]$, and $[30, 50]$?

(A) 290 (B) 360 (C) 380 (D) 390 (E) 430



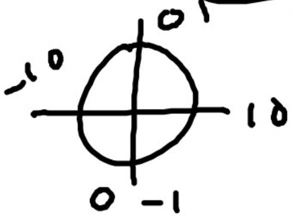
$4(25) + 6(5) + 8(20)$

$100 + 30 + 160$

290

5. Let f be the function defined above, where c is a constant. For what value of c, if any, is f continuous at $x = 2$?

(A) 2 $\qquad$ $\boxed{\text{(B) 7}}$ $\qquad$ (C) 9 $\qquad$ (D) $4\pi - 4$ $\qquad$ (E) There is no such value of c.



$$f(x) = \begin{cases} x^2 \sin \pi x & x < 2 \\ x^2 + cx - 18 & x \geq 2 \end{cases}$$

$$\cancelto{0}{4 \sin 2\pi} = 4 + 2c - 18$$

$$0 = -14 + 2c$$

$$c = 7$$

6. Which of the following is an antiderivative of $3\sec^2 x + 2$?

(A) $3\tan x$ (B) $3\tan x + 2x$ (C) $3\sec x + 2x$ (D) $\sec^3 x + 2x$ (E) $6\sec^2 x \tan x$

$3 \tan x + 2x$

7. If $f(x) = x^2 - 4$ and g is a differentiable function of x, what is the derivative of $f(g(x))$?

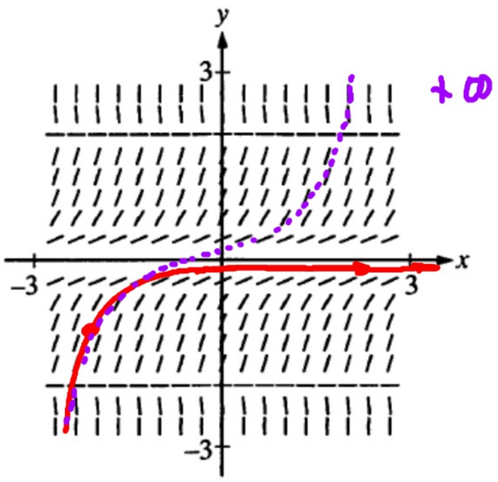
(A) $2g(x)$ (B) $2g'(x)$ (C) $2xg'(x)$ (D) $2g(x)g'(x)$ (E) $2g(x) - 4$

$f'(g(x))\,g'(x)$

$f'(x) = 2x$

$f'(g(x)) = 2g(x)$

$2g(x)g'(x)$



8. Shown above is a slope field for the differential equation $\frac{dy}{dx} = y^2\left(4 - y^2\right)$. If $y = g(x)$ is the solution to the differential equation with the initial condition $g(-2) = -1$, then $\boxed{\lim_{x\to\infty} g(x) \text{ is}}$

(A) $-\infty$ (B) -2 (C) 0 (D) 2 (E) 3

9. If $f''(x) = x(x+2)^2$, then the graph of f is concave up for

(A) $x < 0$

(B) $x > 0$

(C) $-2 < x < 0$

(D) $x < -2$ and $x > 0$

(E) all real numbers

$f''(x) > 0$

$x(x+2)^2$

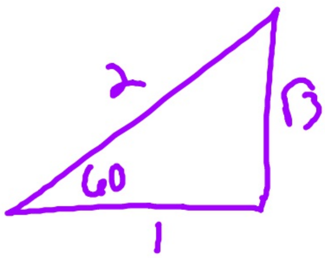
$+ \quad +$

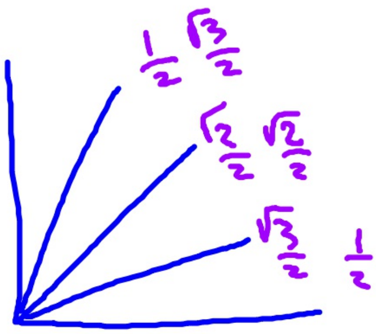
10. If $y = \sin x \cos x$, then at $x = \frac{\pi}{3}$, $\frac{dy}{dx} =$

(A) $-\frac{1}{2}$ (B) $-\frac{1}{4}$ (C) $\frac{1}{4}$ (D) $\frac{1}{2}$ (E) 1

$$\frac{dy}{dx} = -\sin x \sin x + \cos x \cos x$$

$$-\frac{\sqrt{3}}{2}\frac{\sqrt{3}}{2} + \frac{1}{2}\cdot\frac{1}{2}$$





$$-\frac{3}{4} + \frac{1}{4}$$

$$-\frac{2}{4}$$

$$-\frac{1}{2}$$

11. $\lim_{x \to -3} \frac{x^2 - 9}{x^2 - 2x - 15}$ is

9+6-1

(A) 0 (B) $\frac{3}{5}$ (C) $\frac{3}{4}$ (D) 1 (E) nonexistent

$\frac{0}{0}$

$\frac{2x}{2x-2}$ $\frac{-6}{-6-2}$

$= \frac{3}{4}$