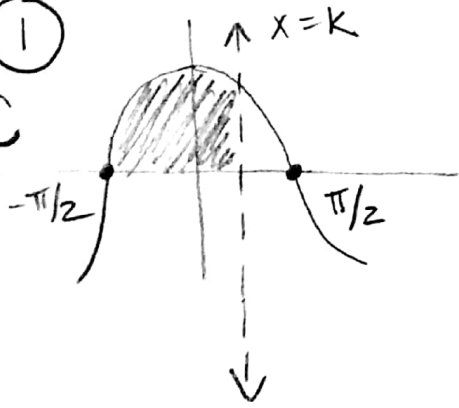


PS Unit 6:

①

C



$$\int_{-\pi/2}^k \cos x dx = 3 \int_k^{\pi/2} \cos x dx$$

$$\sin x \Big|_{-\pi/2}^k = 3 \sin x \Big|_k^{\pi/2}$$

$$\sin k - \sin(-\frac{\pi}{2}) = 3(\sin \frac{\pi}{2} - \sin k)$$

$$\sin k + 1 = 3(1 - \sin k)$$

$$\sin k + 1 = 3 - 3 \sin k$$

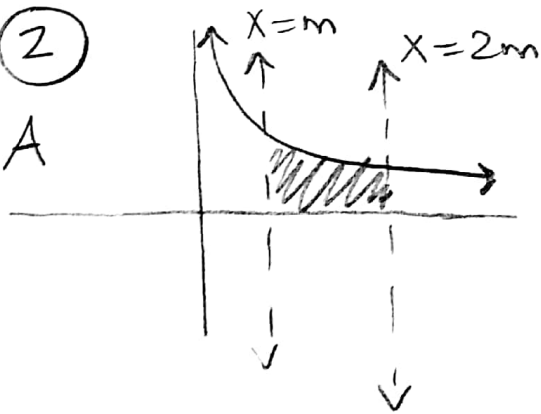
$$4 \sin k = 2$$

$$\sin k = \frac{1}{2}$$

$$k = \frac{\pi}{6}$$

②

A



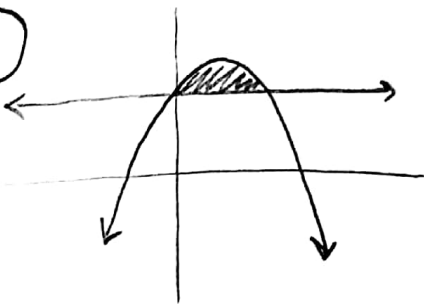
$$A = \int_m^{2m} \frac{1}{x} dx = \ln|x| \Big|_m^{2m}$$

$$\ln(2m) - \ln(m)$$

$$\ln 2 + \cancel{\ln m} - \cancel{\ln m} = \ln 2$$

③

C



$$4 = -x^2 + x + 6$$

$$-x^2 + x + 2 = 0$$

$$x^2 - x - 2 = 0$$

$$(x-2)(x+1) = 0$$

$$x = 2, -1$$

$$\int_{-1}^2 (-x^2 + x + 6 - 4) dx$$

$$\int_{-1}^2 (-x^2 + x + 2) dx$$

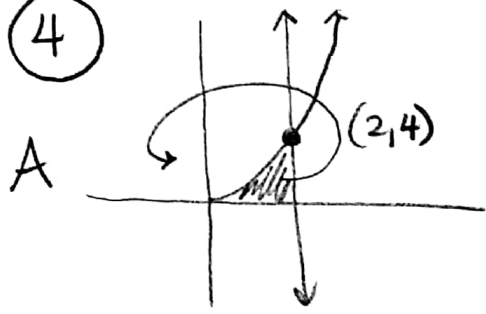
$$= \left. -\frac{x^3}{3} + \frac{x^2}{2} + 2x \right|_{-1}^2$$

$$\left(-\frac{8}{3} + \frac{6}{3} + \frac{12}{3} \right) - \left(\frac{1}{3} + \frac{1}{2} - 2 \right)$$

$$\frac{10}{3} + \frac{7}{6}$$

$$\frac{27}{6} = \frac{9}{2}$$

④



$$R = 2$$

$$r = \sqrt{y}$$

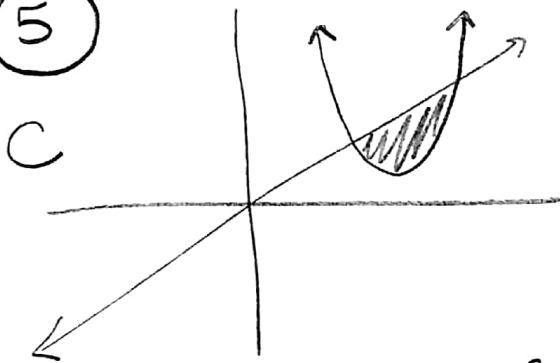
$$\pi \int_0^4 [2^2 - (\sqrt{y})^2] dy$$

$$\pi \int_0^4 (4 - y) dy$$

$$\pi \left(4y - \frac{y^2}{2} \Big|_0^4 \right)$$

$$\pi (16 - 8) = 8\pi$$

⑤



$$x^2 - 3x + 3 = x$$

$$x^2 - 4x + 3 = 0$$

$$(x-1)(x-3) = 0$$

$$x=1, x=3$$

$$\int_1^3 (x - (x^2 - 3x + 3)) dx$$

$$\int_1^3 (-x^2 + 4x - 3) dx$$

$$\left. -\frac{x^3}{3} + 2x^2 - 3x \right|_1^3 = (-9 + 18 - 9) - \left(-\frac{1}{3} + 2 - 3\right)$$

$$= -\left(-\frac{1}{3} + \frac{6}{3} - \frac{9}{3}\right)$$

$$= \frac{4}{3}$$

⑥ $\frac{d}{dx} (x^{\ln x})$

C $y = x^{\ln x}$

$$\ln y = \ln x^{\ln x}$$

$$\ln y = \ln x \cdot \ln x$$

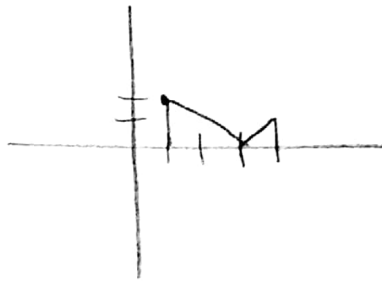
$$\ln y = (\ln x)^2$$

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

$$\frac{dy}{dx} = \frac{2 \ln x}{x} \cdot y$$

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

⑦ $\int_1^4 |x-3| dx$
C



$$\frac{1}{2}(2)(2) + \frac{1}{2}(1)(1)$$

$$2 + \frac{1}{2} = \frac{5}{2}$$

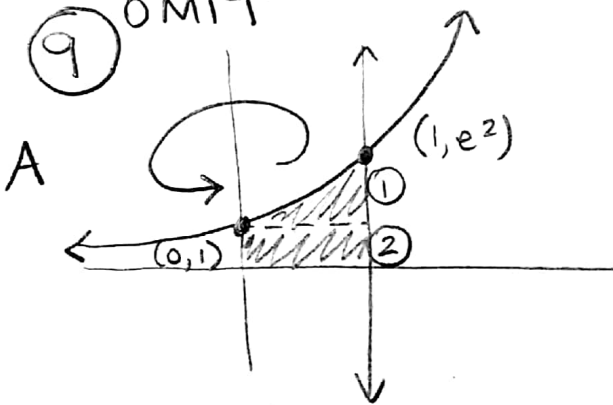
⑧ $\lim_{h \rightarrow 0} \frac{\tan 3(x+h) - \tan 3x}{h}$
B

$$f(x) = \tan(3x)$$

$$f'(x) = \sec^2(3x) \cdot 3$$

$$= 3 \sec^2(3x)$$

⑨ OMIT



$$\textcircled{1} \pi \int_0^1 1^2 dy + \textcircled{2} \pi \int_1^{e^2} \left(1 - \frac{\ln y}{2}\right)^2 dy$$

calc = 13.177

matches answer A

$$y = e^{2x}, x=1, x=0$$

$$\ln y = \ln e^{2x}$$

$$\ln y = 2x$$

$$x = \frac{\ln y}{2}$$

⑩ $y = x^3 - 3x^2 + 12$ $[-2, 4]$

A $y' = 3x^2 - 6x = 0$
 $3x(x-2) = 0$
 $x = 0, x = 2$

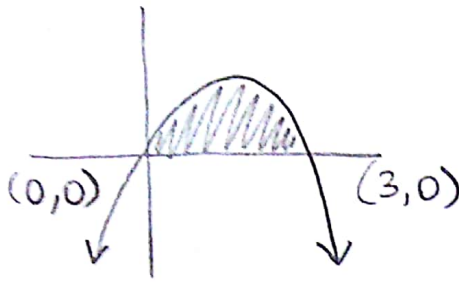
x	f(x)
-2	-8
0	12
2	8
4	28

Abs max

⑪ $\int_a^c [f(x) - g(x)] dx$

⑫ $y = 3x - x^2$ avg value

C



$$\frac{\int_0^3 (3x - x^2) dx}{3 - 0}$$

$$\frac{\left. \frac{3x^2}{2} - \frac{x^3}{3} \right|_0^3}{3} = \frac{\frac{27}{2} - 9}{3} = \frac{\frac{27}{2} - \frac{18}{2}}{3}$$

$$= \frac{9}{2} \cdot \frac{1}{3} = \frac{9}{6} = \frac{3}{2}$$

⑬ $V = \pi r^2 \cdot h = 16\pi$

D

$$r^2 = \frac{16}{h}$$

$$r = \sqrt{\frac{16}{h}} = \frac{4}{\sqrt{h}} = 4h^{-1/2}$$

$$A = 2\pi r h + 2\pi r^2$$

$$A = 2\pi(4h^{-1/2})(h) + 2\pi(4h^{-1/2})^2$$

$$A = 8\pi h^{1/2} + 32\pi h^{-1}$$

$$\frac{dA}{dh} = 4\pi h^{-1/2} - 32\pi h^{-2}$$

$$\frac{4\pi}{\sqrt{h}} - \frac{32\pi}{h^2} = 0$$

$$4\pi \left(\frac{1}{\sqrt{h}} - \frac{8}{h^2} \right) = 0$$

$$\frac{1}{\sqrt{h}} - \frac{8}{h^2} = 0$$

$$\frac{1}{\sqrt{h}} = \frac{8}{h^2}$$

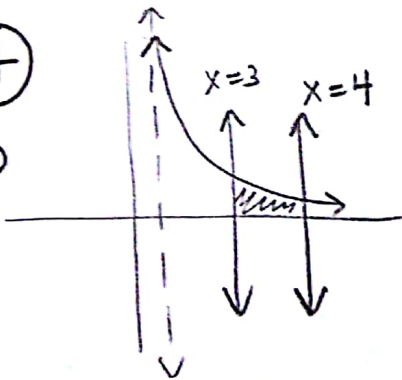
$$8\sqrt{h} = h^2$$

$$8 = h^{3/2}$$

$$4 = h$$

⑭

D



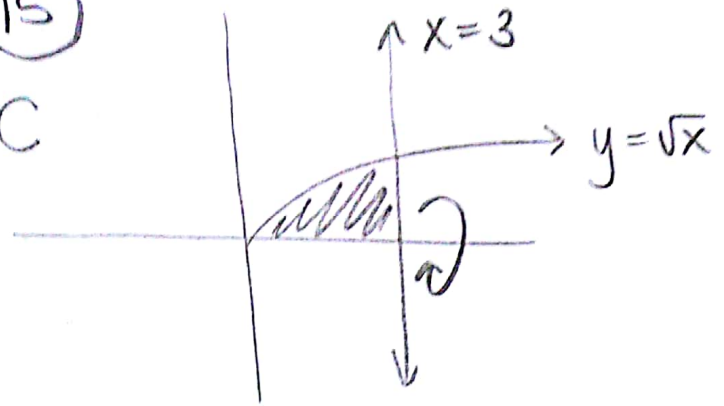
$$\int_3^4 \frac{1}{x-1} dx$$

$$= \ln|x-1| \Big|_3^4$$

$$\ln 3 - \ln 2 = \ln \frac{3}{2}$$

15

C



$$\pi \cdot \int_0^3 (\sqrt{x})^2 dx$$

$$\pi \cdot \frac{x^2}{2} \Big|_0^3$$

$$\frac{9\pi}{2}$$

16 A