1. $\int_1^4 \frac{\sqrt{y} - y}{y^2}\, dy =$

(a) $1 - 2 \ln 2$

(b) $- \ln 4$

(c) $1 + 2 \ln 2$

(d) $1 + 2\sqrt{2}$

(e) $-2\sqrt{2} - 1$

2. Using four rectangles, taking the sample points to be left endpoints, the estimate of the area under the graph of $f(x) = \sin^2 x$ from $x = 0$ to $x = \pi$ is equal to

(a) $\frac{\pi}{2}$

(b) $\frac{\pi}{3}$

(c) $\frac{\pi}{4}$

(d) $\frac{\pi}{8}$

(e) π

3. The limit $\lim_{n\to\infty} \sum_{i=1}^{n} \sec^2\left(\frac{i\,\pi}{4n}\right) \cdot \frac{\pi}{4\,n}$ is equal to

(a) 1

(b) 2

(c) $\sqrt{2}$

(d) $\frac{\sqrt{2}}{2}$

(e) 4

4. For $f(x) = \begin{cases} |x|, & -3 \le x < 3 \\ 2(x-3), & 3 \le x \le 6 \end{cases}$
the value of the integral $\int_{-3}^{6} f(x)\,dx =$

(a) 18

(b) 16

(c) 15

(d) 14

(e) 12

5. A particle moves along a line with velocity $v(t) = t - 2$ (in meters per seconds). For the first three seconds, the particle travels a total distance of

(a) 2.5 meters

(b) 4 meters

(c) 3.5 meters

(d) 3 meters

(e) 4.5 meters

6. $\dfrac{d}{dx}\displaystyle\int_0^{\tan x} \frac{dt}{1+t^2} =$

(a) 1

(b) $\tan x$

(c) $\dfrac{1}{1+\tan^2 x}$

(d) $\dfrac{1}{\tan x}$

(e) $\cos x$

7. $\displaystyle\int_0^{1/2} \frac{dw}{\sqrt{1-w^2}} =$

(a) $\dfrac{\pi}{6}$

(b) $\dfrac{2\,\pi}{3}$

(c) $\dfrac{5\,\pi}{6}$

(d) $\dfrac{4\,\pi}{3}$

(e) $\dfrac{7\,\pi}{6}$

8. $\displaystyle\int_0^{1} 4e^x \sinh x\, dx =$

(a) $e^2 - 3$

(b) $e^2 - 4$

(c) $e^2 + 4$

(d) $e^2 - 1$

(e) $e^2 + 1$

9. $\displaystyle\int \left(\frac{2-x}{x^7}\right)^{1/3} dx =$

(a) $\dfrac{-3}{8}\left(\dfrac{2}{x}-1\right)^{4/3}+C$

(b) $\dfrac{3}{4}\left(\dfrac{2}{x}-1\right)^{4/3}+C$

(c) $\dfrac{-3}{2}\left(\dfrac{2}{x}-1\right)^{4/3}+C$

(d) $\dfrac{-3}{4}\left(\dfrac{2}{x}-1\right)^{-2/3}+C$

(e) $\dfrac{-3}{2}\left(\dfrac{2}{x}-1\right)^{-2/3}+C$

10. $\displaystyle\int_{-3}^{3} (4+\sin x)\,\sqrt{9-x^2}\,dx =$

(a) $18\,\pi$

(b) $16\,\pi$

(c) $8\,\pi$

(d) 0

(e) $\dfrac{9\,\pi}{4}$

11. Given that

$$\int \cos^3 x\, dx = g(x) - \frac{1}{3}\sin^3 x + C,$$

where C is an arbitrary constant, then $g(x) =$

(a) $\sin x$

(b) $\cos x$

(c) $\frac{1}{2}\sin^2 x$

(d) $\frac{1}{2}\cos^2 x$

(e) $\frac{1}{3}\cos^3 x$

12. Let f be an even function such that $\int_0^4 f(x)\, dx = 5$. Then, $\int_{-2}^{2} (2 + f(2x))\ dx =$

(a) 13

(b) 10

(c) 12

(d) 7

(e) 14

13. $\displaystyle\int \frac{dx}{1+(x-1)^2} =$

(a) $\tan^{-1}(x-1)+C$

(b) $\tan^{-1} x + C$

(c) $\dfrac{1}{2}\tan^{-1}(x-1)+C$

(d) $-\tan^{-1}(x-1)+C$

(e) $-\tan^{-1} x + C$

14. The area of the region enclosed by the curves $x = y^2 - 4y$ and $x = 2y - y^2$ is equal to

(a) 9

(b) 18

(c) 27

(d) 24

(e) 12

15. The area of the region enclosed by the curves

$$y = \sin 2x \quad \text{and} \quad y = \tan x, \qquad \frac{-\pi}{4} \le x \le \frac{\pi}{4},$$

is equal to

(a) $1 - \ln 2$

(b) $1 + 2 \ln 2$

(c) $2 + \ln 2$

(d) $4 - \ln 2$

(e) $4 + \ln 2$

16. The base of a solid is the region enclosed by the parabola $x = 1 - y^2$ and the y-axis. Cross-sections perpendicular to the x-axis are squares. Then, the volume of the solid is

(a) 2

(b) 3

(c) 4

(d) 5

(e) 6

17. The value of the integral

$$\int_0^1 x^3 \sqrt{1-x^2}\, dx$$

is

(a) $\frac{2}{15}$

(b) $\frac{7}{15}$

(c) $\frac{1}{6}$

(d) $\frac{5}{6}$

(e) $\frac{3}{5}$

18. If the region enclosed by the curves $y = x$ and $y = x^2$ is rotated about the line $x = -1$, then the volume of the obtained solid is

(a) $\frac{\pi}{2}$

(b) $\frac{\pi}{4}$

(c) π

(d) $\frac{3\pi}{2}$

(e) $\frac{5\pi}{4}$

19. For some real number b and a continuous function f,

$$6 + \int_b^x \frac{f(t)}{t^2}\, dt = 2\sqrt{x}, \text{ for } x > 0.$$

Then, $f(b) =$

(a) 27

(b) 24

(c) 18

(d) 12

(e) 21

20. $\displaystyle\int \frac{\sin 4x}{\cos 2x}\, dx =$

(a) $-\cos 2x + C$

(b) $2 \sin 2x + C$

(c) $\sin 2x + C$

(d) $2 \cos x + C$

(e) $\cos 4x + C$