1. If $\frac{5x^2 - x + 3}{x(x^2+1)} = \frac{A}{x} + \frac{Bx + C}{x^2+1}$, then $A + B + C =$

(a) 4

(b) 3

(c) 2

(d) 1

(e) 0

2. If the average value of $f(x) = x^2$ over $[0, b]$ is a, then $b =$

(a) $\sqrt{3a}$

(b) $-\sqrt{3a}$

(c) $2\sqrt{a}$

(d) $-2\sqrt{a}$

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

3. The volume of the solid obtained by rotating the region bounded by the graphs of

$$y = \sqrt{x}, \quad y = 0, \quad x = 1 \text{ and } \quad x = 5$$

about the x-axis is equal to

(a) $12\,\pi$

(b) $10\,\pi$

(c) $8\,\pi$

(d) $6\,\pi$

(e) $4\,\pi$

4. $\int_0^{\pi/2} 3 \sin\, x\, \sin\, 2x\, dx =$

(a) 2

(b) 3

(c) 4

(d) 6

(e) 12

5. Using the method of cylindrical shells, the volume of the solid obtained by rotating the region bounded by the curves

$$y = 1 - x^2 \quad \text{and} \quad y = 0$$

about the line $x = -1$ is equal to

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

(b) $2\pi \int_{0}^{1} (x+1)(1-x^2)\,dx$

(c) $2\pi \int_{0}^{1} (x-1)(1-x^2)\,dx$

(d) $4\pi \int_{0}^{1} (x+1)(1-x^2)\,dx$

(e) $4\pi \int_{-1}^{1} (x+1)(1-x^2)\,dx$

6. The volume of the solid obtained by rotating the region enclosed by the curves

$$y = x^2 \quad \text{and} \quad y = \sqrt{x},$$

about the line $y = -1$ is equal to

(a) $\pi \int_{0}^{1} [(\sqrt{x}+1)^2 - (x^2+1)^2]\,dx$

(b) $\pi \int_{0}^{1} [(x+1)^2 - (x^4+1)^2]\,dx$

(c) $\pi \int_{0}^{1} (x - x^4)\,dx$

(d) $\pi \int_{0}^{1} [(\sqrt{x}-1)^2 + (x^2-1)^2]\,dx$

(e) $2\pi \int_{0}^{1} [(\sqrt{x}-1)^2 - (x^2-1)^2]\,dx$

7. $\displaystyle\int_1^{\sqrt{3}} \frac{dx}{\sqrt{1+x^2}} =$

(a) $\ln\left(\dfrac{2+\sqrt{3}}{1+\sqrt{2}}\right)$

(b) $\ln\left(\dfrac{2-\sqrt{3}}{\sqrt{2}-1}\right)$

(c) $\ln\left(\dfrac{2+2\sqrt{3}}{1+2\sqrt{2}}\right)$

(d) $\ln\left(\dfrac{3+\sqrt{3}}{2+\sqrt{2}}\right)$

(e) $\ln\left(\dfrac{3-\sqrt{3}}{2-\sqrt{2}}\right)$

8. Using integration by parts, $\displaystyle\int_1^{e} 2x \ln x \, dx =$

(a) $\dfrac{e^2+1}{2}$

(b) $\dfrac{e^2+3}{2}$

(c) $\dfrac{e^2-3}{2}$

(d) $\dfrac{e^2}{2}$

(e) $\dfrac{3e^2}{2}$

9. $\displaystyle\int_1^2 \frac{du}{u(1+u)} =$

(a) $\ln\left(\frac{4}{3}\right)$

(b) $\ln\left(\frac{3}{2}\right)$

(c) $\ln\left(\frac{9}{2}\right)$

(d) $\ln\left(\frac{7}{2}\right)$

(e) $\ln\left(\frac{11}{2}\right)$

10. $\displaystyle\int_0^5 \sqrt{100-x^2}\, dx =$

(a) $25\left(\frac{\pi}{3}+\frac{\sqrt{3}}{2}\right)$

(b) $75\left(\frac{\pi}{3}+\frac{\sqrt{3}}{2}\right)$

(c) $20\left(\frac{\pi}{3}+\frac{\sqrt{3}}{2}\right)$

(d) $32\left(\frac{\pi}{3}+\frac{\sqrt{3}}{2}\right)$

(e) $10\left(\frac{\pi}{3}+\frac{\sqrt{3}}{2}\right)$

11. Using a trigonometric substitution,

$$\int_1^{\sqrt{2}} \frac{\sqrt{x^2-1}}{x}\,dx =$$

(a) $1 - \frac{\pi}{4}$

(b) $1 - \frac{\pi}{2}$

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

(d) $3 - \frac{\pi}{4}$

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

12. $\int 3\sec x \tan^3 x\,dx =$

(a) $\sec^3 x - 3\sec x + C$

(b) $\sec^3 x + 9\sec x + C$

(c) $\sec^3 x - 6\sec x + C$

(d) $\sec^3 x - 4\sec x + C$

(e) $\sec^3 x + 6\sec x + C$

13. $\int_{-1}^{0} \frac{dx}{x^2 + 2x + 2} =$

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

(b) π

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

(d) $2\,\pi$

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

14. $\int_{0}^{\pi/3} \frac{dx}{1 - \sin\, x} =$

(a) $1 + \sqrt{3}$

(b) $2 + \sqrt{3}$

(c) $3 + \sqrt{3}$

(d) $4 + \sqrt{3}$

(e) $5 + \sqrt{3}$

15. The improper integral

$$\int_0^1 \frac{\cos^{-1} x}{\sqrt{1-x^2}}\, dx =$$

(a) $\frac{\pi^2}{8}$

(b) $\frac{\pi^2}{9}$

(c) $\frac{\pi^2}{3}$

(d) $\frac{\pi^2}{12}$

(e) ∞

16. $\int_{-1}^{3} e^{\sqrt{t+1}}\, dt =$

(a) $2e^2 + 2$

(b) $e^2 + 1$

(c) $2e^2 + 1$

(d) $2e^2 - 1$

(e) $2e^2 - 2$

17. The base of a solid is bounded by the curve $x^2 + y^2 = 4$. If parallel cross-sections perpendicular to the x-axis are squares, then the volume of the solid is

(a) $\frac{128}{3}$

(b) $\frac{125}{3}$

(c) $\frac{124}{3}$

(d) $\frac{121}{3}$

(e) $\frac{118}{3}$

18. $\int_0^{\infty} e^{-x} \sin x \, dx =$

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

(b) $\frac{1}{4}$

(c) $\frac{3}{2}$

(d) 0

(e) ∞

19. The volume of the solid obtained by rotating the region bounded by

$$y = \frac{\sin x}{x}, \quad y = 0, \quad \frac{\pi}{2} \le x \le 2\pi,$$

about the y-axis is equal to

(a) 6π

(b) 4π

(c) 2π

(d) 8π

(e) 10π

20. $\displaystyle\int_0^{\pi/6} \sec x \tan x \, e^{\sin x} \, dx + \int_0^{\pi/6} e^{\sin x} \, dx =$

(a) $2\sqrt{\frac{e}{3}} - 1$

(b) $2\sqrt{\frac{e}{3}} + 2$

(c) $3\sqrt{\frac{e}{2}} - 1$

(d) $3\sqrt{\frac{e}{2}} - 2$

(e) $2\sqrt{\frac{e}{3}} - 2$