1. \[ \int_e^e \frac{1}{x\sqrt{\ln x}} \, dx = \]
(a) 0  (b) 2  (c) 4  (d) \(e^2\)  (e) \(e^4 - e\)

2. What is the volume of the solid obtained by rotating the area between the graph of \(y = \frac{1}{1 + e^{2x}}\) and the x-axis for \(0 \leq x \leq \sqrt{\ln 2}\) around the y-axis.
(a) \(5\pi \ln 2 - 3\pi \ln 3\)  (b) \(8\pi \ln 2 - 4\pi \ln 3\)  (c) \(15\pi \ln 3 - 10\pi \ln 2\)
(d) \(2\pi \ln 2 - \pi \ln 3\)  (e) \(42\pi \ln 2 - 24\pi \ln 3\)

3. \[ \int_1^e x(\ln x) \, dx = \]
(a) \(\frac{e^4}{4} - \frac{4}{e^4}\)  (b) \(\frac{e^4}{2} - \frac{2}{e^4}\)  (c) \(\frac{3e^4}{4}\)
(d) \(\frac{e^4}{4} + \frac{1}{4}\)  (e) \(\frac{3e^4}{2} - \frac{1}{4e^4}\)  (f) \(\frac{e^4}{4}\)

4. What is the volume of the solid obtained by rotating the part of the graph of \(y = \cos x \sqrt{\sin x}\) between \(x = 0\) and \(x = \frac{\pi}{2}\) around the x-axis?
(a) \(\pi\)  (b) \(\frac{\pi}{2}\)  (c) \(\frac{\pi}{3}\)
(d) \(\frac{\pi}{4}\)  (e) \(\frac{\pi}{6}\)

5. \[ \lim_{b \to \infty} \int_0^b \frac{\arctan x}{1 + x^2} \, dx = \]
(a) \(\frac{\pi^2}{2}\)  (b) \(\pi^2\)  (c) \(\frac{\pi^2}{4}\)  (d) \(\frac{\pi^2}{8}\)  (e) \(+\infty\)

6. The area between a curve \(y = f(x)\) and the x-axis between \(x = 1\) and \(x = b\) is rotated around the x-axis and the volume of the resulting solid is \(\frac{\pi}{3} (\ln b)^3\), for all \(b > 1\). What is \(f(x)\)?
(a) \((\ln x)^2\)  (b) \(\frac{\ln x}{\sqrt{x}}\)  (c) \(\frac{\ln x}{x}\)  (d) \(\frac{(\ln x)^2}{x}\)  (e) \(\frac{(\ln x)^2}{\sqrt{x}}\)
7. \( \int_0^\pi \sin^2(2x) \, dx = \)
(a) 0  (b) 1  (c) 1/2  (d) \(\pi/2\)  (e) \(\pi\)  (f) 2\(\pi\)

8. The area bounded by the curves \( y = x^2 - 1 \) and \( y = 2x + 7 \) is
(a) 4  (b) 9  (c) 16  (d) 24  (e) 30  (f) 36

9. \( \frac{d}{dx} \int_0^{\sin x} e^{\cos^2 t} \, dt = \)
(a) \(e^{\sin^2 x}\)  (b) \(\cos x\, e^{\sin^2 x}\)  (c) \(2\sin x\, e^{\sin^2 x}\)
(d) \(\cos x + e^{\sin^2 x}\)  (e) \(2\sin x\, e^{\sin^2 x} + e^{\sin^2 x}\)  (f) \(e^{\cos^2 x}\)

10. What is the average value of the function \( f(x) = \sqrt{\arcsin \frac{x}{1-x^2}} \) on the interval \([0, \frac{1}{2}]\)?
(a) \(\frac{\pi \sqrt{6}}{15}\)  (b) \(\frac{\pi^{3/2} \sqrt{2}}{54}\)  (c) \(\frac{\pi \sqrt{3}}{18}\)
(d) \(\frac{\pi^{3/2} \sqrt{6}}{27}\)  (e) \(\frac{\pi \sqrt{2}}{48}\)

11. The functions \( \cosh x \) and \( \sinh x \) are defined as \( \cosh x = \frac{1}{2}(e^x + e^{-x}) \) and \( \sinh x = \frac{1}{2}(e^x - e^{-x}) \). Calculate the area bounded by the curves \( y = \cosh x \), \( y = \sinh x \), \( x = 0 \) and \( x = b \). What is the limit of this area as \( b \to \infty \)?
(a) 1  (b) \(e\)  (c) \(e + \frac{1}{e}\)  (d) \(\frac{1}{e}\)  (e) \(\infty\)

12. What is the volume obtained by revolving the region bounded by \( y = x^2 - 4 \) and \( y = 4 - x^2 \) around the line \( x = 2 \)?
(a) \(\frac{16\pi}{3}\)  (b) \(\frac{64\pi}{3}\)  (c) \(\frac{256\pi}{3}\)  (d) \(\frac{512\pi}{3}\)  (e) \(\frac{1024\pi}{3}\)

13. \( \int_0^{\pi/4} \frac{\cos \sqrt{x}}{\sqrt{x}} \, dx = \)
(a) 0  (b) 1  (c) \(\sqrt{2}\)  (d) 2  (e) \(2\sqrt{2}\)  (f) 3

14. Compute \( \int (\sin^2 x + 8)^7 \sin x \cos x \, dx \).
(a) \(\frac{1}{16}(\sin^2 x + 8)^8 + C\)  (b) \((\cos^2 x + 8)^7 + C\)  (c) \(\frac{1}{2}(\sin^2 x + 8)^8 + C\)
(d) \(\frac{1}{8}(\sin^2 x + 8)^8 + C\)  (e) \(\frac{1}{8}(\cos^2 x + 8)^8 + C\)  (f) \(\frac{1}{32}(\sin^2 x + 8)^7 + C\)
15. Suppose $f$ is a continuous function and $\int_1^9 f(x) \, dx = 6$. Then $\int_1^3 x f(x^2) \, dx =$

(a) 6  (b) 4  (c) 3  (d) 2  (e) 1  (f) 0