Exercise 1: The integral
\[
\int_{-2}^{2} (x^5 + 3)\sqrt{4 - x^2} \, dx
\]
is equal to
(a) 6\pi
(b) 3\pi
(c) \frac{\pi}{2}
(d) 3 + 2\pi
(e) 5 + 2\pi

Exercise 2: If
\[
F(x) = \int_{1}^{x^2} \frac{1}{2\sqrt{t}} \tan^{-1}\left(\sqrt{t}\right) \, dt , \quad x > 0
\]
then \(F(1) + F'(1) + F''(1)\) is equal to
(a) \frac{\pi + 2}{4}
(b) \frac{\pi - 2}{4}
(c) \frac{2\pi - 1}{2}
(d) \frac{\pi + 1}{2}
(e) 0
Exercise 3: The integral
\[ \int \frac{1}{x^2} \sqrt{2 - \frac{1}{x}} \, dx \]
is equal to
(a) \( \frac{2}{3} \left[ 2 - \frac{1}{x} \right]^{3/2} + C \)
(b) \( 3 \left[ 2 - \frac{1}{x} \right]^{1/3} + C \)
(c) \( 2 \left[ 2 - \frac{1}{x} \right]^{1/2} + C \)
(d) \( \frac{1}{3} \left[ 2 - \frac{1}{x} \right]^{3/2} + C \)
(e) \( \left[ 2 - \frac{1}{x} \right]^{3/2} + C \)

Exercise 4: The area of the region below the line \( y = 1 \) and between the curves \( y = \tan x \) and \( x = 0 \) is equal to
(a) \( \frac{1}{4} (\pi - 2 \ln 2) \)
(b) \( \frac{1}{3} (\pi + \ln 2) \)
(c) \( \frac{\pi}{4} - 1 \)
(d) \( \frac{\pi}{2} + \ln 2 \)
(e) \( \frac{\pi}{4} - \ln 2 \)
Exercise 5: The volume of the solid generated by rotating the region bounded by the curves \( y = x \) and \( y = \sqrt{x} \) about the line \( x = -1 \) is given by
\[
\begin{align*}
(a) & \quad \int_0^1 \pi \left[ (y + 1)^2 - (y^2 + 1)^2 \right] dy \\
(b) & \quad \int_0^1 \pi \left[ (y - 1)^2 - (y^2 + 2)^2 \right] dy \\
(c) & \quad \int_0^1 \pi \left[ y^2 - y^4 \right] dy \\
(d) & \quad \int_0^1 \pi \left[ (y - 1)^2 - (y^2 - 1)^2 \right] dy \\
(e) & \quad \int_0^1 \pi \left[ y^4 - y^2 + 2y - 1 \right] dy
\end{align*}
\]

Exercise 6: The region bounded by the curve \( y = 2\sqrt{x} \), the \( x \)-axis, and the line \( x = 4 \) is rotated about the \( y \)-axis. The volume of the solid generated is equal to
\[
\begin{align*}
(a) & \quad \frac{26}{7} \pi \\
(b) & \quad \frac{26}{3} \pi \\
(c) & \quad \frac{28}{3} \pi \\
(d) & \quad \frac{26}{5} \pi \\
(e) & \quad \frac{26}{4} \pi
\end{align*}
\]
**Exercise 7:** The sum of the series

\[
\frac{(\ln 3)^2}{2!} + \frac{(\ln 3)^3}{3!} + \frac{(\ln 3)^4}{4!} + \cdots
\]

is equal to
(a) \(2 - \ln 3\)
(b) \(3\)
(c) \(\ln 3\)
(d)\(1 + \ln 3\)
(e) \(2\)

**Exercise 8:** The length of the curve

\[
y = \int_0^x \sqrt{\sec^4 t - 1} \, dt , \quad 0 \leq x \leq \frac{\pi}{4}
\]

is equal to
(a) \(1\)
(b) \(\sqrt{2}\)
(c) \(3 - \sqrt{2}\)
(d) \(2\)
(e) \(1 + \sqrt{3}\)
Exercise 9: The area of the surface obtained by rotating the curve \( y = \cosh x \), \( 0 \leq x \leq 1 \) about the \( y \)-axis is given by

- (a) \( \int_0^1 2\pi x \cosh x \, dx \)
- (b) \( \int_0^1 2\pi x \sinh x \, dx \)
- (c) \( \int_0^1 2\pi \cosh x \sinh x \, dx \)
- (d) \( \int_0^1 2\pi x \cosh x \sinh x \, dx \)
- (e) \( \int_0^1 2\pi x \sech x \, dx \)

Exercise 10: The integral

\[
\int \frac{dx}{2\sqrt{x} + 2x}
\]

is equal to

- (a) \( \ln (1 + \sqrt{x}) + C \)
- (b) \( \ln (\sqrt{x}) + C \)
- (c) \( 2 \ln (1 + \sqrt{x}) + C \)
- (d) \( \frac{1}{2} \ln (1 + \sqrt{x}) + C \)
- (e) \( \ln (x + \sqrt{x}) + C \)
**Exercise 11:** The integral

\[ \int_0^1 e^t \cosh t \, dt \]

is equal to

(a) \( \frac{1}{4} (e^2 + 1) \)
(b) \( \frac{1}{2} (e^2 + 1) \)
(c) \( e^2 - 1 \)
(d) \( \frac{1}{2} (e - 2) \)
(e) \( \frac{1}{3} (e + 2) \)

**Exercise 12:** The integral

\[ \int_0^{\frac{\pi}{2}} e^\cos x \sin (2x) \, dx \]

is equal to

(a) 2
(b) \(-\frac{1}{2}\)
(c) 0
(d) 3
(e) \(-4\)
Exercise 13: The integral
\[ \int \frac{\sin^3 x}{\cos^4 x} \, dx \]

is equal to

(a) \( \frac{1}{3} \sec^3 x - \sec x + C \)
(b) \( 3 \sec x - \frac{1}{3} \sec^3 x + C \)
(c) \( \sec^3 x + \sec x + C \)
(d) \( \sec^2 x + \frac{1}{3} \sec^3 x + C \)
(e) \( -\sec^3 x + \frac{1}{3} \sec x + C \)

Exercise 14: If \( x > 2 \), the integral
\[ \int \frac{\sqrt{x^2 - 4}}{x} \, dx \]

is equal to

(a) \( \sqrt{x^2 - 4} - 2 \sec^{-1} \left( \frac{x}{2} \right) + C \)
(b) \( \frac{2\sqrt{x^2 - 4}}{x} - 2 \sec^{-1} \left( \frac{x}{2} \right) + C \)
(c) \( 2\sqrt{x^2 - 4} + 2 \tan^{-1} \left( \frac{x}{2} \right) + C \)
(d) \( x - 2 \sec^{-1} \left( \frac{x}{2} \right) + C \)
(e) \( 2x\sqrt{x^2 - 4} - 2 \sec^{-1} \left( \frac{x}{2} \right) + C \)
Exercise 15: If
\[ \frac{3x^2 + 2x + 1}{(x-1)(x^2 + 2x + 5)} = \frac{A}{x-1} + \frac{Bx + C}{x^2 + 2x + 5} \]
then \( A + B + C \) is equal to
(a) \( \frac{23}{7} \)
(b) \( \frac{12}{7} \)
(c) \( \frac{21}{7} \)
(d) \( \frac{17}{5} \)
(e) 0

Exercise 16: The integral
\[ \int \frac{x^2 + 2x - 1}{2x^3 + 3x^2 - 2x} \, dx \]
is equal to
(a) \( \frac{1}{2} \ln |x| + \frac{1}{10} \ln |2x - 1| - \frac{1}{10} \ln |x + 2| + C \)
(b) \( \ln |x| + \ln |2x - 1| - \ln |x + 2| + C \)
(c) \( \frac{1}{2} \ln |x| - \ln |x + 2| + C \)
(d) \( \frac{1}{2} \ln |x| + \frac{1}{2} \ln |2x - 1| + 3 \ln |x + 2| + C \)
(e) \( 2 \ln |x| + 3 \ln |2x - 1| - 3 \ln |x + 2| + C \)
Exercise 17: The integral
\[ \int_{2}^{\infty} \frac{dx}{x(\ln x)^p} \]
converges for
(a) \( p > 1 \)
(b) \( p = 0 \)
(c) \( p = -1 \)
(d) \( p = 1 \)
(e) \( p < 1 \)

Exercise 18: The sequence
\[ \left\{ \left( 1 - \frac{2}{5n} \right)^{5n} \right\}_{n \geq 1} \]
is
(a) convergent and its limit is \( e^{-2} \)
(b) convergent and its limit is \( e^{-5} \)
(c) convergent and its limit is \( e^{-2/5} \)
(d) convergent and its limit is \( e^{3} \)
(e) divergent
Exercise 19: The series

\[ \sum_{n \geq 1} \frac{\sin(n\pi) + 2^n}{3^n} \]

is equal to
(a) 2
(b) 3
(c) 33
(d) \( \frac{2}{33} \)
(e) 6

Exercise 20: Which of the following proposition is True about the series

\[ \sum_{n \geq 1} \frac{n}{n^2 + 1} \]

(a) Diverges by the integral test
(b) Converges by the integral test
(c) Converges by the \( n^{th} \) term test
(d) Diverges by the \( n^{th} \) term test
(e) The integral test cannot be applied
Exercise 21: The series

\[ \sum_{n \geq 1} \frac{4}{n(n + 2)} \]

is equal to
(a) 3
(b) 4
(c) 5
(d) 7
(e) 1024

Exercise 22: The series

\[ \sum_{n \geq 1} \left( \frac{3n}{4n + 1} \right)^n \]

is
(a) Convergent by the root test
(b) Divergent by the root test
(c) A series for which the root test is inconclusive
(d) Divergent by the n\textsuperscript{th}-term test of Divergence
(e) Divergent by the limit comparison test
**Exercise 23:** The series

\[ \sum_{n \geq 1} \frac{3^{n+2}}{\ln n} \]

is

(a) Divergent by the ratio test
(b) Convergent by the ratio test
(c) A series for which the ratio test is inconclusive
(d) Convergent by the \( n^{th} \) root test
(e) The ratio test cannot be applied

**Exercise 24:** Which of the following proposition is False about the series

\[ \sum_{n \geq 1} (-1)^{n+1} \frac{n}{n^3 + 1} \]

(a) Diverges
(b) Converges absolutely
(c) Converges
(d) Converges by the alternating series test
(e) converges with the absolute convergence test and the alternating series test
Exercise 25: Which of the following proposition is True about the series

\[ \sum_{n \geq 1} (-1)^{n+1} \frac{n!}{2^n} \]

(a) Diverges
(b) Converges absolutely
(c) Converges by the ratio test
(d) Converges by the integral test
(e) converges absolutely by the ratio test

Exercise 26: The interval of convergence of the power series

\[ \sum_{n \geq 1} \left( 1 + \frac{1}{n} \right)^n (x - 1)^n \]

is

(a) (0, 2)
(b) [0, 2]
(c) \( \left( \frac{e-1}{e}, \frac{e+1}{e} \right) \)
(d) \([-1, 3)\)
(e) [0, 2)
Exercise 27: The interval of convergence of the power series

\[ \sum_{n \geq 1} \frac{5^n}{n} (x + 1)^n \]

is

(a) \([-\frac{6}{5}, -\frac{4}{5}]\)
(b) \((-\frac{6}{5}, -\frac{4}{5})\)
(c) \([-\frac{6}{5}, -\frac{4}{5}]\)
(d) \((-2, 1)\)
(e) \([-2, 1]\)

Exercise 28: The Taylor series of \(e^{2x} \sin x\) is

(a) \(x + 2x^2 + \frac{11}{5}x^3 + \ldots\)
(b) \(x - 3x^2 + \frac{11}{6}x^3 + \ldots\)
(c) \(x + 2x^2 + \frac{11}{5}x^3 + \ldots\)
(d) \(x - 3x^2 + \frac{11}{6}x^3 + \ldots\)
(e) \(x + 2x^2 - \frac{11}{5}x^3 + \ldots\)