1) Evaluate the integral $\int \frac{1+\ln x}{x \ln x}\, dx$.

a. $\ln x + C$

b. $\ln \ln x + C$

c. $x + \ln x + C$

d. $\ln x + \ln \ln x + C$

e. $\frac{x}{\ln x} + C$

f. $\frac{\ln x}{(x + \ln x)} + C$

g. $x \ln x + C$

h. $x \ln \ln x + C$

2) Evaluate $\int \cos(\ln x) dx$.

a. $\sin(\ln x) + C$

b. $\frac{x^2}{2}\left[\cos(\ln x) + \sin(\ln x)\right] + C$

c. $\cos\left(\frac{1}{x}\right) + C$

d. $\frac{x}{4}\left[\cos(\ln x) + \sin(\ln x)\right] + C$

e. $\frac{\sin x}{x} + C$

f. $x\left[\cos(\ln x) + \sin(\ln x)\right] + C$

g. $-\sin\left(\frac{1}{x}\right) + C$

h. $\frac{x}{2}\left[\cos(\ln x) + \sin(\ln x)\right] + C$

3) Use the Trapezoidal Rule with $n = 1$ to approximate the integral $\int_0^1 \left(\sqrt{x} + 2\right) dx$.

a. $\frac{1}{2}$

b. $\frac{9}{16}$

c. $\frac{7}{16}$

d. $\frac{1}{4}$

e. $\frac{3}{8}$

f. $\frac{2}{3}$

g. $\frac{5}{2}$

h. $\frac{5}{8}$

4) Use the Midpoint Rule with $n = 4$ to approximate the integral $\int_1^3 \frac{1}{x}\, dx$.

a. $\frac{3776}{3465}$

b. $\frac{7552}{3465}$

c. $\frac{1888}{3465}$

d. $\frac{7}{32}$

e. $\frac{5}{16}$

f. $\frac{5}{32}$

g. $\frac{7}{16}$

h. $\frac{5}{2}$

5) Evaluate the improper integral $\int_1^\infty \frac{1}{x(x+1)}\,dx$.

a. $\frac{1}{2}\ln 4$
b. $\ln 4$
c. $-\ln 4$
d. $-\frac{1}{3}\ln 4$
e. $\frac{1}{3}\ln 4$
f. $\ln 2$
g. $-\frac{1}{2}\ln 4$
h. Divergent

6) Find the area of the region bounded by the curves $y = x^3 - 2x$ and $y = -x$

a. $\frac{1}{4}$
b. $\frac{1}{9}$
c. $\frac{1}{18}$
d. $\frac{2}{15}$
e. $\frac{1}{2}$
f. $\frac{1}{6}$
g. 4
h. 2

7) The base of a solid $S$ is the parabolic region $\left\{(x,y)\,\middle|\, y^2 \le x \le 1\right\}$. Cross-sections perpendicular to the $x$-axis are squares. Find the volume of $S$.

a. 1.5
b. 1.6
c. 1.7
d. 1.8
e. 1.9
f. 2.0
g. 2.1
h. 2.2

8) The density of a rod 9 meters long is $\sqrt{x}$ kg/m at a distance of $x$ meters from one end of the rod. Find the average density of the rod.

a. 6
b. $\frac{4}{3}$
c. 3
d. 1
e. 2
f. $\frac{16}{3}$
g. 4
h. $\frac{8}{3}$

9) Evaluate the following integrals:

(a) $\int x\sec^2 x\,dx$

(b) $\int \left(3x^2+1\right)\ln\left(x^2+1\right)dx$

(c) $\int \frac{e^{\sqrt{x}}}{\sqrt{x}}\,dx$

(d) $\int e^{\sqrt{x}}\,dx$

10) Let $f$ be a twice differentiable function such that $f(0)=5$, $f(3)=1$, and $f'(3)=-2$. Determine the value of $\int_0^3 x\cdot f''(x)\,dx$.

11) Evaluate the improper integral

$$\int_0^\infty \frac{x^2+2x+2}{(x^2+1)(x^2+2)}\,dx$$

or show that it is divergent.

12) Suppose that $f$, $f'$, and $f''$ are all positive on the interval $[0,1]$.
Order from greatest to least the quantities

$(a)$ $\int_0^1 f(x)\,dx$

$(b)$ $\frac{1}{4}\left[f\left(\frac{1}{8}\right)+f\left(\frac{3}{8}\right)+f\left(\frac{5}{8}\right)+f\left(\frac{7}{8}\right)\right]$

$(c)$ $\frac{1}{8}f(0)+\frac{1}{4}f\left(\frac{1}{4}\right)+\frac{1}{4}f\left(\frac{1}{2}\right)+\frac{1}{4}f\left(\frac{3}{4}\right)+\frac{1}{8}f(1)$

13) $f$ is a positive function and $x\,f(x)$ has an average value of 3.8 on the interval $[3, 6]$. What is the volume of the region obtained by rotating the area under the graph of $f$ between $x = 3$ and $x = 6$ about the $y$-axis?

14) A motor spins faster as it warms up. The RPM (instantaneous revolutions per minute) after a given number of revolutions is shown in the following graph. Estimate the time it takes to complete 10,000 revolutions; using a numerical rule with $n = 5$ is sufficient accuracy.

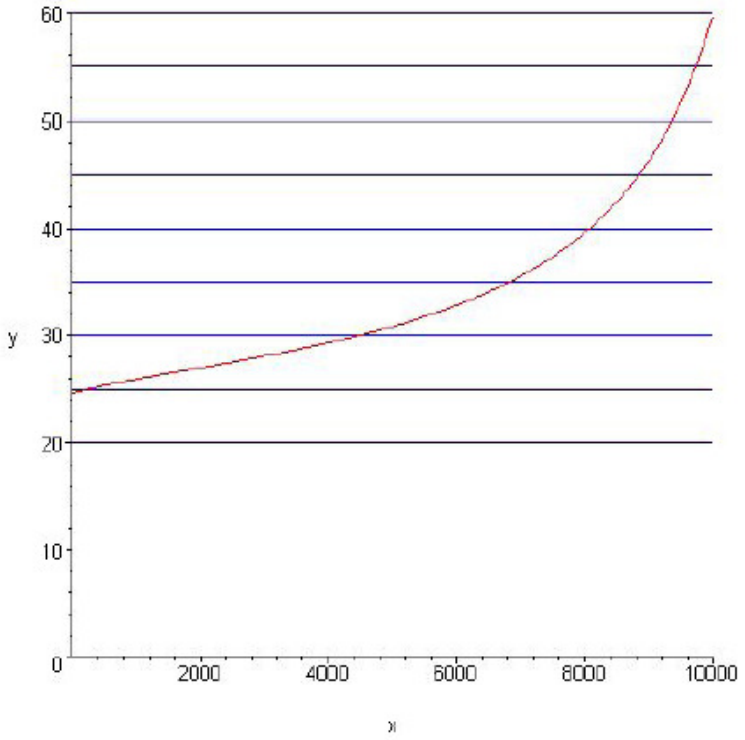


Figure 1: RPM versus number of revolutions completed

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**Answers to 1-10**

**1)** D
**2)** H
**3)** G
**4)** A
**5)** F
**6)** E
**7)** F
**8)** E

**9)** (a) $\ln|\cos x| + x\tan x + C$

(b) $\left(x^3 + x\right)\ln\left(x^2 + 1\right) - \frac{2x^3}{3} + C$

(c) $2e^{\sqrt{x}} + C$

(d) $2e^{\sqrt{x}}\left(\sqrt{x} - 1\right) + C$

**10)** -2