

- ① IF $f(x) = x^2 (\ln x)^2$, FIND THE CRITICAL NUMBERS AND RELATIVE EXTREMA FOR f .
- ② SET UP (BUT DO NOT EVALUATE) AN INTEGRAL FOR THE VOLUME OF THE SOLID FORMED BY REVOLVING THE REGION BOUNDED BY THE GRAPHS OF $y = x^2 + 1$ AND $y = 2x + 9$ ABOUT THE x -AXIS.
- ③ CALCULATE THE VOLUME OF THE SOLID FORMED BY REVOLVING THE REGION IN THE 1ST QUADRANT BOUNDED BY THE GRAPHS OF $y = \ln x$ AND $y = 2$ AND THE x -AXIS AND y -AXIS ABOUT THE y -AXIS.
- ④ FIND THE TOTAL AREA BETWEEN THE GRAPHS OF $y = \sin \frac{x}{2}$ AND $y = \cos \frac{x}{2}$ FOR $0 \leq x \leq 2\pi$.
- ⑤ FIND THE AVERAGE VALUE OF $f(x) = (x+1)\sqrt{x-1}$ ON $[1, 5]$.
- ⑥ SUPPOSE THE NUMBER OF HOURS T YOU WILL WAIT IN LINE FOR TICKETS HAS A PROBABILITY DENSITY FUNCTION GIVEN BY $f(t) = \frac{1}{9}t(4-t)$, $0 \leq t \leq 3$.
- a) FIND THE EXPECTED NUMBER OF HOURS YOU WILL WAIT IN LINE,
 b) FIND THE PROBABILITY YOU WILL WAIT IN LINE AT LEAST 1 HOUR.
- ⑦ FIND THE FOLLOWING INTEGRALS:
- a) $\int \frac{\cos 2x}{\sin x} dx$
- b) $\int x \sec^2 x dx$
- c) $\int \frac{4x^2 - 2x - 9}{2x^2 - 5x - 3} dx$
- d) $\int \frac{4}{6x + 5x^{2/3}} dx$
- ⑧ EVALUATE $\int_0^{\infty} \frac{1}{x^2 e^{4/x}} dx$, OR SHOW THAT IT DIVERGES.
- ⑨ ASSUME THAT THE VALUE OF A NEW CAR DEPRECIATES EXPONENTIALLY, THE CAR ORIGINALLY COST \$20,000, AND EXACTLY 4 YEARS LATER IT IS WORTH \$14,000.
- a) IN HOW MANY YEARS WILL THE CAR BE WORTH HALF OF ITS ORIGINAL VALUE?
 b) HOW MUCH WILL THE CAR BE WORTH AFTER EXACTLY 8 YEARS?
 (SIMPLIFY YOUR ANSWER.)

① FIND THE FOLLOWING DEFINITE INTEGRALS.

a) $\int_0^1 \frac{24x}{(2x^2+1)^3} dx$

b) $\int_0^4 \frac{x+4}{x^2+8x+6} dx$

② APPROXIMATE $\int_1^{25} \frac{1}{x+5} dx$ WITH $n=4$ USING

a) THE MIDPOINT RULE,

(YOU DO NOT NEED TO SIMPLIFY NUMERICALLY.)

b) THE TRAPEZOIDAL RULE.

③ USE PROPERTIES OF LOGARITHMS TO SIMPLIFY $y = \ln \left[\frac{(x^2+9)^5 \sqrt{e^{4x}+7}}{\sqrt[3]{x} \sin^8(6x)} \right]$, AND THEN FIND $\frac{dy}{dx}$.

④ SKETCH THE REGION BOUNDED BY THE GRAPHS OF $x=y^2$ AND $x=y+2$, AND THEN FIND THE AREA OF THE REGION.

⑤ FIND THE FOLLOWING DEFINITE INTEGRALS,

a) $\int_1^e x^3 \ln x dx$

b) $\int_{\pi/6}^{\pi/4} \frac{\cos 2\theta}{\sin^5 2\theta} d\theta$

⑥ THE LIFETIME T OF A BATTERY IS EXPONENTIALLY DISTRIBUTED, WITH A MEAN OF 3 YEARS. FIND THE PROBABILITY THAT A BATTERY WILL LAST AT LEAST 2 YEARS.

⑦ FIND THE FOLLOWING INDEFINITE INTEGRALS,

a) $\int \frac{3e^{2x}}{\sqrt{5e^{2x}+8}} dx$

b) $\int \frac{5x^3 - 4x + 8}{x^3 - 2x^2} dx$

⑧ FIND $\int_4^9 \frac{\sqrt{x}}{\sqrt{x}-1} dx$,

⑨ THE NUMBER OF FRUITFLIES IN AN EXPERIMENT INCREASES ACCORDING TO THE LAW OF EXPONENTIAL GROWTH. IF THERE ARE 100 FRUITFLIES INITIALLY AND 400 FRUITFLIES AFTER 5 HOURS, HOW LONG DOES IT TAKE THE NUMBER OF FRUITFLIES TO INCREASE BY 60%?

⑩ DETERMINE WHETHER EACH OF THE FOLLOWING IMPROPER INTEGRALS CONVERGES OR DIVERGES. IF THE INTEGRAL CONVERGES, EVALUATE IT.

a) $\int_{-\infty}^0 x^3 e^{-2x^4} dx$

b) $\int_0^{\frac{2\pi}{3}} \tan x dx$

⑪ FIND THE FOLLOWING INDEFINITE INTEGRALS,

a) $\int \theta \csc^2 \theta d\theta$

b) $\int e^{2x} \cos 3x dx$

⑫ IF X IS A RANDOM VARIABLE WITH PROBABILITY DENSITY FUNCTION $f(x) = \frac{9}{x^3}$, $[2, 6]$,
a) FIND THE MEAN FOR X . b) FIND THE VARIANCE FOR X .

⑬ FIND THE AREA OF THE REGION INSIDE THE GRAPH OF $y^2 = x^2(9-x^2)$.

⑭ a) FIND THE VOLUME OF THE SOLID GENERATED BY REVOLVING THE REGION INSIDE THE ELLIPSE $\frac{x^2}{25} + \frac{y^2}{9} = 1$ AROUND THE x -AXIS.

b) FIND THE VOLUME OF THE SOLID GENERATED BY REVOLVING THE REGION BOUNDED BY THE GRAPHS OF $y = \frac{x^2}{2}$ AND $y = 8$ AROUND THE y -AXIS.