

Workbook



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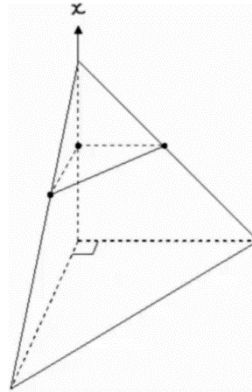
Early Transcendentals – 14th Edition

Applications of Definite Integrals

Volumes Using Cross-Sections

Questions

- 1) Find the formula for computing the volume of a right pyramid with height h and whose base is a square with side of length a .
- 2) Find a formula for computing the volume of a right pyramid with height c and whose base is a right triangle with legs of lengths a and b respectively.
[For simplicity, you may assume that the apex is directly above the right-angle of the base]



Answer Key

- 1) $V = \frac{a^2 h}{3}$
- 2) $V = \frac{abc}{6}$

Arc Length

Questions

- 1) Find the length of the curve $y = x^{\frac{2}{3}}$ between $x=1$ and $x=8$.
- 2) Find the length of the curve $y = \frac{x^4}{8} + \frac{1}{4x^2}$ from $x=1$ to $x=2$.
- 3) Find the length of the curve $y = \frac{x^5}{15} + \frac{1}{4x^3}$ from $x=1$ to $x=2$.
- 4) Find the length of the curve $y = \frac{2}{3}(1+x^2)^{3/2}$ between $x=0$ and $x=3$.
- 5) Find the length of the curve $y = \frac{1}{3}\sqrt{x}(3-x)$ between $x=0$ and $x=3$.
- 6) Find the length of the curve $y = \ln x$ from $(1,0)$ to $(2,\ln 2)$.
- 7) Find the length of the curve $y = x^2$ between $x=1$ and $x=2$.

You can use the formula: $\int \sqrt{x^2 \pm a^2} dx = \frac{1}{2}x\sqrt{x^2 \pm a^2} \pm \frac{1}{2}a^2 \ln \left| x + \sqrt{x^2 \pm a^2} \right|$.

- 8) Find the length of the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = 4$ between $x=1$ and $x=8$.
- 9) Find the length of the curve $x = \frac{2}{3}y^{\frac{2}{3}}$ between $y=0$ and $y=3$.
- 10) Find the length of the curve $x = \frac{y^4}{4} + \frac{1}{8y^2}$ between $y=1$ to $y=2$.

11) Find the distance traveled between $t = 0$ and $t = \frac{\pi}{2}$ by a particle $P(x, y)$, whose position at time t is given by: $x = \cos t + t \sin t$, $y = \sin t - t \cos t$.

12) Find the distance traveled between $t = 0$ and $t = 4$ by a particle $P(x, y)$, whose position at time t is given by: $x = \frac{t^2}{2}$, $y = \frac{1}{3}(2t+1)^{3/2}$.

13) Find the distance traveled between $t = 0$ and $t = 4$ by a particle $P(x, y)$, whose position at time t is given by: $x = \frac{1}{3}(2t+3)^{3/2}$, $y = \frac{t^2}{2} + t$.

Answer Key

1) $l = \frac{(\sqrt{40})^3 - (\sqrt{13})^3}{27} = 7.63$

2) $2\frac{1}{14}$

3) $\frac{1097}{480}$

4) 21

5) $2\sqrt{3}$

6) 1.22

7) 2.32

8) 9

9) $\frac{14}{3}$

10) $\frac{123}{32}$

11) $\frac{\pi^2}{8}$

12) 12

13) 16

Areas of Surfaces of Revolution

Questions

- 1) Write the formulae for computing the surface area of the solid obtained by rotating a curve respectively about:
 - a. The x -axis.
 - b. The y -axis.
- 2) Determine the surface area of the solid obtained by rotating the graph of $y = \sqrt{4 - x^2}$, $-1 \leq x \leq 1$ about the x -axis.
- 3) State and prove the formula for computing the surface area of a cone.
- 4) Determine the surface area of the solid obtained by rotating the graph of $x = \sqrt{9 - y^2}$, $-2 \leq x \leq 2$ about the y -axis.

Answer Key

- 1) a. $S = 2\pi \int_a^b f(x) \sqrt{1 + (f'(x))^2} dx$ b. $S = 2\pi \int_c^d g(y) \sqrt{1 + (g'(y))^2} dy$
- 2) 8π
- 3) $S = \pi r l = \pi r \sqrt{h^2 + r^2}$
- 4) 24π

Work and Fluid Forces

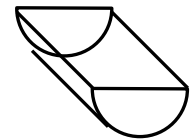
Questions

Work

- 1) A spring has a natural length of 20 inches. A 4 lbs force, stretch it to 30 inches. How much work to stretch from 35 to 38 inches?
- 2) A Chain of 2lbs/ft is attached to a bucket of coal of 800lb at bottom of mine shaft, 500ft . Determine the amount of work needed to lift the bucket up the shaft.
- 3) Cylindrical tank is half full with oil of $\rho = 60\text{lb/ft}^3$. Its radius is 4ft and its height is 9ft . What is the work done in pumping out the oil to the top of the tank?

Hydrostatic Pressure and Force

- 4) Given a tank of water which is half cylindrical as described. The radius of $r = 10\text{m}$. Find the hydrostatic force on the bases of the tank.



Answer Key

- 1) 19.8 inch-lbs.
- 2) 650,000 ft-lbs.
- 3) $\cong 90,000$ ft-lbs.
- 4) 654,0000 Newtons.

Moments and Centers of Mass

Questions

- 1) Find the center of mass of the shape created by the function $f(x) = 4 - x^2$ and the positive rays of the axis. Assume unit weight distribution.
- 2) Find the center of mass of the area between: $y = \sqrt{x}$ and $y = x^2$.

Answer Key

- 1) $\left(\frac{3}{4}, \frac{8}{5}\right)$
- 2) $\left(\frac{9}{20}, \frac{9}{20}\right)$