

1. Evaluate the following definite or indefinite integrals

(a) $\int_0^1 (2 + x\sqrt{x})dx$

(b) $\int \frac{3x}{x^2-4}dx$

(c) $\int_{-10}^{10} \sin^3 x dx$

(d) $\int \frac{t}{t^4+1}dt$

(e) $\int \frac{\cos \sqrt{x}}{\sqrt{x}}dx$

(f) $\int_1^9 \frac{3x-1}{\sqrt{x}}dx$

(g) $\int \frac{1+3x}{x^2+1}dx$

(h) $\int_0^2 x\sqrt{4-x^2}dx$

2. A particle is moving along a line with acceleration $a(t) = 4 - 2t$ with initial velocity $v(0) = 12$.

(a) When will the particle move to left or right?

(b) Find the displacement of the particle during the given time interval $0 \leq t \leq 10$.

(c) Find the distance traveled by the particle during the time interval $0 \leq t \leq 10$.

(d) At what time will the particle return to the initial place?

3. Find the derivatives of the following functions (Do not expect that you can find explicit formula of the function)

(a) $f(x) = \int_1^{e^x} \sqrt{t+t^3}dt$

(b) $g(x) = \int_{2x}^{3x+2} \sin(t^4)dt$

(c) $h(x) = \int_0^{x^4} \sqrt{t^2+1}dt$

4. Consider the region enclosed by $x = 0$, $y = x$ and $y = \sqrt{16-x^2}$. Find the volume of the solid by rotating the region with respect to x -axis

5. Consider the solid with base (on xy -plane) as a triangle with vertices $(0, 0)$, $(5, 0)$ and $(2, 3)$. Assume that the parallel cross-section, which is perpendicular to the base and is parallel to x -axis is of the following shape, find the volume of the solid in each cases.

(a) the cross-sections are squares.

(b) the cross-sections are equilateral triangles.

(c) the cross-sections are isosceles right triangles with hypotenuse in the base.

6. Find the area of the region enclosed by

(a) $y = 2 - x^2$ and $y = |x|$.

(b) $x = 1 + y^2$ and $y = x - 3$

7. Find the average value of the function $f(x) = (x - 3)^2$ in the interval $[2, 5]$. Then find value c in the interval $[2, 5]$ which satisfies $f(c) = f_{ave}$.