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4.1

(5) $\int \left(\frac{1}{z^3} - \frac{3}{z^2}\right) dz$ (7) $\int \left(7\sqrt{u} + \frac{1}{\sqrt{u}}\right) du$

(11) $\int (3x-1)^2 dx$ (14) $\int (2x-5)(3x+1) dx$

(15) $\int \frac{8x-5}{\sqrt[3]{x}} dx$ (17) $\int \frac{x^3-1}{x-1} dx$

(23) $\int \frac{7}{\csc x} dx$ (27) $\int \frac{\sec t}{\cos t} dt$

(29) $\int \csc v \cot v \sec v \, dv$ (35) $\int \frac{d}{dx}\left(\sqrt{x^2+4}\right) dx$

4.2

(9) $\int \sqrt{3x-2}\, dx$ (16) $\int v\sqrt{9-v^2}\, dv$

(20) $\int (3-s^3)^2 s\, ds$ (21) $\int \frac{(\sqrt{x}+3)^4}{\sqrt{x}} dx$

(27) $\int \cos(4x-3)\, dx$ (37) $\int \frac{\sin x}{\cos^4 x} dx$

(32) $\int \frac{\sin(2x)}{\sqrt{1-\cos(2x)}} dx$

4.3

Express the sum in terms of n.

(9) $\sum_{k=1}^{n} (k^2+3k+5)$ (12) $\sum_{k=1}^{n} (3k^3+k)$

(27) Approximate the area under the graph of $f(x) = 3-x$ from $a=-2$ to $b=2$. Approximate A by dividing $[a,b]$ into subintervals of equal length $\Delta x = 1$ and using (a) A_{IP} and (b) A_{CP}
10 14

4.4

(11) Find the Riemann Sum R_p for $f(x) = x^3$ on the interval $[-2,6]$ with a regular partition p of size $n=32$ by choosing on each subinterval of p (a) the left-hand endpoint (b) the right hand endpoint (c) the midpoint
292.5 348.5 319.75

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(10) نفس السؤال السابق

$f(x) = \sqrt{x}$, $P = \{1, 3, 4, 9, 12, 16\}$, $n = 5$

(16) Use def of definite integral to express the limit $\lim_{\|P\| \to 0} \sum_{k=1}^{n} \pi (w_k^2 - 4) \Delta x_k$ as a definite integral on the interval $[0, 4]$

Given $\int_1^4 \sqrt{x}\, dx = \frac{14}{3}$

(19) Evaluate $\int_4^1 \sqrt{x}\, dx$

(20) $\int_1^4 \sqrt{s}\, ds$

Evaluate the definite integral by regarding it as the area under the graph of a function.

25 (31) $\int_{-3}^{2} (2x + 6)\, dx$ 2.5 (33) $\int_0^3 |x - 1|\, dx$

$12 + 2\pi$ (37) $\int_{-2}^{2} \left(3 + \sqrt{4 - x^2}\right) dx$

$\boxed{4.5}$

(15) Verify the inequality without evaluating the integral: $\int_0^{2\pi} (1 + \sin x)\, dx \geq 0$

(22) $\int_c^m f(x)\, dx - \int_d^m f(x)\, dx$ as one integral

(25) (a) Find z MVT (1)

(b) Find average value of f on $[-3, 1]$

~~Ex~~ $\int_{-2}^{1} (x^2 + 1)\, dx = 6$ (2)

1) Approximate the integral $\int_1^3 \sqrt{1+x^3}\,dx$ for $n=5$, using the $\boxed{\text{Trapezoidal rule}}$.

Solution: $f(x) = \sqrt{1+x^3}$, $a=1$, $b=3$, $\Delta x = \frac{b-a}{n} = 0.4$

$x_0 = a = 1$ $\quad$ $x_1 = x_0 + \Delta x = 1.4$ $\quad$ $x_2 = x_1 + \Delta x = 1.8$ $\quad$ $x_3 = x_2 + \Delta x = 2.2$ $\quad$ $x_4 = x_3 + \Delta x = 2.6$ $\quad$ $x_5 = b = 3$

i	x_i	m_i	$f(x_i)$	$m f(x_i)$
0	0	1	1.41421356237	1.41421356237
1	1.4	2	1.93494185959	3.86988371918
2	1.8	2	2.61380948043	5.22761896086
3	2.2	2	3.41291664123	6.82583328246
4	2.6	2	4.30998839906	8.61997679812
5	3	1	5.29150262213	5.29150262213

$\text{sum} = \sum_{i=0}^{5} m_i f(x_i) = 31.24902894515$

$$\int_1^3 \sqrt{1+x^3}\,dx \approx \frac{\Delta x}{2}[\text{sum}] = 0.2\,[31.24902894515] = 6.24980578903$$

2) Approximate the integral $\int_0^{\pi} \cos(\sin x)\,dx$ for $n=6$, using the $\boxed{\text{Simpson's rule}}$.

Solution: $f(x) = \cos(\sin x)$, $a=0$, $b=\pi$, $\Delta x = \frac{b-a}{n} = \frac{\pi}{6}$

$x_0 = a = 0$ $\quad$ $x_1 = x_0 + \Delta x = \frac{\pi}{6}$ $\quad$ $x_2 = x_1 + \Delta x = \frac{\pi}{3}$ $\quad$ $x_3 = x_2 + \Delta x = \frac{\pi}{2}$ $\quad$ $x_4 = x_3 + \Delta x = \frac{2\pi}{3}$ $\quad$ $x_5 = x_4 + \Delta x = \frac{5\pi}{6}$ $\quad$ $x_6 = b = \pi$

i	x_i	m_i	$f(x_i)$	$m f(x_i)$
0	0	1	$\cos(0) = 1$	1
1	$\pi/6$	4	$\cos(\frac{1}{2}) = 0.999962$	3.999848
2	$\pi/3$	2	$\cos(\frac{\sqrt{3}}{2}) = 0.433013$	0.866026
3	$\pi/2$	4	$\cos(1) = 0.998477$	3.993908
4	$2\pi/3$	2	$\cos(\frac{\sqrt{3}}{2}) = 0.433013$	0.866026
5	$5\pi/6$	4	$\cos(\frac{1}{2}) = 0.999962$	3.999848
6	π	1	$\cos(0) = 1$	1

$\text{sum} = \sum_{i=0}^{6} m_i f(x_i) = 15.725656$

$$\int_0^{\pi} \cos(\sin x)\,dx \approx \frac{\Delta x}{3}[\text{sum}] = \frac{\pi}{18}[15.725656] = 2.74644742$$

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4.6

(17) $\int_1^{1} (4x^2-5)\,dx$ (21) $\int_{-3}^{6} |x-4|\,dx$ $\frac{53}{2}$

Find the derivative without integrating

(45) $\frac{d}{dx}\int_0^3 \sqrt{x^2+16}\,dx$ (47) $\frac{d}{dx}\int_0^x \frac{1}{t+1}\,dt$

4.7

(15) Approximate $\int^3 \sqrt{1+x^3}\,dx$ using trapezoidal rule for $n=5, 10, 20,$ and 40

6.249806

(17) Approximate $\int_0^{\pi} \cos(\sin x)\,dx$ using Simpson's rule for $n=2, 6, 18,$ and 54

2.3987529621 2.4039394306

6.2

(11) Find $f'(x)$: $f(x) = \ln\sqrt{7-2x^3}$

(35) Use implicit diff to find y': $3y - x^2 + \ln(xy) = 2$

(41) Use logarithmic diff to find $\frac{dy}{dx}$:
$y = \sqrt{4x+7}\,(x-5)^3$

6.3

(3) Find $f'(x)$: $f(x) = e^{3x^2}$

Use implicit diff to find y':

(31) $e^{xy} - x^3 + 3y^2 = 11$ (33) $e^x \cot y = xe^{2y}$

6.4

(11) $\int \frac{x-2}{x^2-4x+9}\,dx$ (15) $\int \frac{\ln x}{x}\,dx$

(19) $\int e^{\sqrt{x}}/\sqrt{x}\,dx$ (31) $\int \frac{\cos^2 x}{\sin x}\,dx$

6.5

Find $f'(x)$:

(1) 7^x (8) $\log(x^4+3x^2+1)$ (15) $\log(\ln x)$

(17) $x^e + e^x$ (23)(e) x^{x^2}

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هذا الهامش

(29) $\int 7^x dx$ (37) $\int \frac{2^x}{2^x+1} dx$

(39) $\int \frac{1}{x \log x} dx$ (42) $\int \frac{5^{\tan x}}{\cos^2 x} dx$

$\boxed{6.7}$

(53) (b) $\int_0^1 \frac{e^x}{1+e^{2x}} dx$ (56) $\int \frac{\cos x}{\sqrt{9-\sin^2 x}} dx$

(60) $\int \frac{dx}{x\sqrt{x^6-4}}$ (61) $\int \frac{1}{\sqrt{e^{2x}-25}} dx$

(62) $\int \frac{1}{x\sqrt{x-1}} dx$

$\boxed{6.8}$

(20) $\int \frac{1}{\operatorname{sech} 7x} dx$ (21) $\int \frac{\sinh \sqrt{x}}{\sqrt{x}} dx$

(28) $\int \sinh x \operatorname{sech}^2 x \, dx$ (29) $\int \cosh x \operatorname{csch}^2 x \, dx$

Find $f'(x)$:

(61) $\sinh^{-1}(5x)$ (63) $\cosh^{-1}\sqrt{x}$ (65) $\tanh^{-1}(-4x)$ (67) $\operatorname{sech}^{-1}(x^2)$

(73) $\int \frac{1}{\sqrt{81+16x^2}} dx$ (74) $\int \frac{1}{\sqrt{16x^2-9}} dx$

(75) $\int \frac{dx}{49-4x^2}$ (79) $\int \frac{1}{x\sqrt{9-x^4}} dx$

(80) $\frac{1}{\sqrt{5-e^{2x}}} dx$

$\boxed{6.9}$

0 (51) $\lim_{x\to\infty} (x^2-1)e^{-x^2}$ (49) $\lim_{x\to 0^+} x \ln x$ 0

e^5 (57) $\lim_{x\to\infty} \left(1+\frac{1}{x}\right)^{5x}$ (59) $\lim_{x\to 0^+} (e^x-1)^x$ 1

(64) $\lim_{x\to\infty} \left(\frac{x^2}{x-1} - \frac{x^2}{x+1}\right)$

$\int \frac{du}{\sqrt{a^2+u^2}} = \sinh^{-1}\left(\frac{u}{a}\right)$ / $\int \frac{du}{\sqrt{u^2-a^2}} = \frac{1}{a}\cosh^{-1}\left(\frac{u}{a}\right)$

$\int \frac{du}{u\sqrt{a^2-u^2}} = \frac{-1}{a}\operatorname{sech}^{-1}\left(\frac{u}{a}\right)$ / $\int \frac{du}{u\sqrt{a^2+u^2}} = \frac{-1}{a}\operatorname{csch}^{-1}\left(\frac{u}{a}\right)$

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u: LIATE

$\boxed{7.1}$

(2) $\int x \sin x \, dx$ (11) $\int \tan^{-1} x \, dx$ ~~(13) $\int \sqrt{x} \ln x \, dx$~~

(16) $\int x \tan^{-1} x \, dx$ (17) $\int e^{-x} \sin x \, dx$

(31) $\int (\ln x)^2 \, dx$

$\boxed{7.2}$

(4) $\int \cos^7 x \, dx$ (3) $\int \sin^2 x \cos^2 x \, dx$

(5) $\int \sin^3 x \cos^2 x \, dx$ (7) $\int \sin^6 x \, dx$

(11) $\int \tan^3 x \sec^4 x \, dx$ (13) $\int \tan^6 x \, dx$

(15) $\int \sqrt{\sin x} \cos^3 x \, dx$

$\boxed{7.3}$

(5) $\int \frac{1}{x^2\sqrt{x^2-25}} dx$ ~~(21) $\int \frac{(4+x^2)^2}{x}$~~ (10) $\int \frac{dx}{\sqrt{4x^2-25}}$

(3) $\int \frac{dx}{x\sqrt{9+x^2}}$ (1) $\int \frac{dx}{x\sqrt{4-x^2}}$

$\boxed{7.4}$

(9) $\int \frac{5x^2-10x-8}{x^3-4x} dx$ (11) $\int \frac{2x^2-25x-33}{(x+1)^2(x-5)} dx$

(25) $\int \frac{x^6-x^3+1}{x^4+9x^3} dx$

$\boxed{7.5}$

(5) $\int \frac{1}{\sqrt{4x-x^2}} dx$ (10) $\int \frac{1}{(x^2-6x+34)^{3/2}} dx$

9.333 (26) $\int_0^{25} \frac{1}{\sqrt{4+\sqrt{x}}} dx$ (27) $\int \frac{\sqrt{x}}{1+\sqrt[3]{x}} dx$

(32) $\int \frac{x^{1/3}+1}{x^{1/3}-1} dx$ (48) $\int \frac{1}{1+\sin x+\cos x} dx$

(50) $\int \frac{1}{\tan x+\sin x} dx$

$\boxed{7.7}$

(15) $\int_{-\infty}^{\infty} x e^{-x^2} dx$ 49

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$\boxed{5.1}$

Sketch and area

(10) $y = x^3$; $y = x^2$

(14) $x = y^2$; $x - y = 2$

(28) $y = 1 - x^2$; $y = x - 1$

9 (31) $y = 6 - 3x^2$; $y = 3x$; $[0, 2]$

$\boxed{5.2}$ (Disk or Washer)

Sketch & volume

(8) $y = \sqrt{x}$, $x = 4$, $y = 0$; x-axis

? 2π (9) $y = x^2$, $y = 2$; y-axis

? (25) $y = x^2$, $y = 4$ about:

(a) $y = 4$ (b) $y = 5$ (c) $x = 2$ (d) $x = 3$

$\frac{512\pi}{15}$ $\frac{832\pi}{15}$ $\frac{128\pi}{3}$ 64π

$\boxed{5.3}$ (Cylindrical shells)

$\frac{24\pi}{5}$ ← (7) $y = x^2$, $y^2 = 8x$; y-axis

$\frac{512\pi}{5}$ (13) $x^2 = 4y$, $y = 4$; x-axis

8π (17) $y = \sqrt{x+4}$, $y = 0$, $x = 0$; x-axis

(21) $y = x^2$, $y = 4$ about:

(a) $y = 4$ (b) $y = 5$ (c) $x = 2$ (d) $x = -3$

$\boxed{5.5}$

Find the arc length of the graph of the equation from A to B

$\frac{8}{27}\left[10^{3/2} - \left(\frac{13}{4}\right)^{3/2}\right]$ (7) $y = 5 - \sqrt{x^3}$; $A(1, 4)$, $B(4, -3)$

(11) $30xy^3 - y^8 = 15$; $A\left(\frac{8}{15}, 1\right)$, $B\left(\frac{271}{240}, 2\right)$

$\frac{353}{240}$

The graph of the equation from A to B is revolved about x-axis. Find the area of the resulting surface

(32) $y = 2\sqrt{x+1}$ $A(0, 2)$, $B(3, 4)$

16π (35) If the smaller arc of the circle $x^2 + y^2 = 25$ between the points $(-3, 4)$ and $(3, 4)$ is revolved about y-axis. Find the area of the resulting surface

$2\int_4^5 2\pi x \sqrt{1 + (x')^2}\, dy =$

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9.1

(a) Find an equation in x and y whose graph contains the points on the curve C (b) Sketch the graph of C and indicate the orientation

(3) $x = t^2 + 1$, $y = t^2 - 1$; $-2 \le t \le 2$

(5) $x = 4t^2 - 5$, $y = 2t + 3$; t in $\mathbb{R}$

9.2

Find the slope of the tangent line and the normal line at the point on the curve that corresponds to $t = 1$

$1; -1$ (1) $x = t^2 + 1$, $y = t^2 - 1$, $-2 \le t \le 2$

$$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}$$

(9) Let C be the curve with: $x = -t^3$, $y = -6t^2 - 18t$ for t in $\mathbb{R}$. Find the point on C at which the slope of the tangent line is $m = 2$ $(-27, -108)$ $(1, 12)$

Find the length of the curve: $L = \int_a^b \sqrt{(x')^2 + (y')^2}\, dt$

(23) $x = e^t \cos t$, $y = e^t \sin t$, $0 \le t \le \frac{\pi}{2}$ $\sqrt{2}(e^{\frac{\pi}{2}} - 1)$

Find the area of the surface generated by revolving the curve about x-axis

$\frac{11\pi}{9}$ (31) $x = t^2$, $y = t - \frac{1}{3}t^3$, $0 \le t \le 1$ $S = \int_a^b 2\pi y \sqrt{(x')^2 + (y')^2}\, dt$

$\frac{64\pi}{3}$ (33) $x = t - \cos t$, $y = 1 - \cos t$, $0 \le t \le 2\pi$

Find the area of the surface generated by revolving the curve about the y-axis

$\frac{536\pi}{5}$ (35) $x = 4t^{\frac{1}{2}}$, $y = \frac{1}{2}t^2 + t^{-1}$, $1 \le t \le 4$

(37) $x = e^t \sin t$, $y = e^t \cos t$; $0 \le t \le \frac{\pi}{2}$

$\frac{2}{5}\sqrt{2}\,\pi(2e^{\pi} + 1)$

$S = \int_c^d 2\pi x \sqrt{(x')^2 + (y')^2}\, dt$

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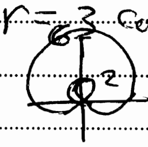
$\boxed{9\text{-}3}$

Sketch the graph of the polar equation

(1) $r=5$ (2) $r=-2$ (3) $\theta=-\frac{\pi}{6}$ (5) $r=3\cos\theta$

(7) $r=4-4\sin\theta$ (9) $r=2+4\sin\theta$



Find a polar equation that has the same graph as the equation in x and y

$r=-3\sec\theta$ (27) $x=-3$ (31) $2y=-x$ $\theta=\tan^{-1}(-\frac{1}{2})$

(33) $y^2-x^2=4$ $r^2=-4\sec 2\theta$

Find an equation in x and y that has the same graph as the polar equation and use it to help sketch the graph in $r\theta$-plane

(37) $r\cos\theta=5$ (38) $r\sin\theta=-2$

Find the slope of the tangent line to the graph of the polar equation at the point corresponding to value of θ

$\frac{\sqrt{3}}{3}$ (51) $r=2\cos\theta$, $\theta=\frac{\pi}{3}$

-1 (53) $r=4(1-\sin\theta)$, $\theta=0$

$\frac{1}{\ln 2}$ (59) $r=2^{\theta}$; $\theta=\pi$

$$m=\frac{\frac{dr}{d\theta}\sin\theta+r\cos\theta}{\frac{dr}{d\theta}\cos\theta-r\sin\theta}$$

$\boxed{9.4}$

Find the area of the region bounded by the graph of the polar equation

$\frac{3\pi}{2}$ (3) $r=1-\cos\theta$

(19) outside $r=2+2\cos\theta$, inside $r=3$ $2\pi+\frac{9}{2}\sqrt{3}$

(22) " $r=1-\sin\theta$ " " $r=3\sin\theta$

23(24) Inside both $r=\sin\theta$, $r=\sqrt{3}\cos\theta$

$\frac{5\pi}{24}-\frac{1}{4}\sqrt{3}$

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Find the length of the curve

(29) $r = e^{-\theta}$ from $\theta = 0$ to $\theta = 2\pi$ $\sqrt{2}\,(1 - e^{-2\pi})$

(30) $r = 2^{\theta}$ $\theta = 0$ to $\theta = \pi$ $L = \int_{\theta_1}^{\theta_2} \sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2}\, d\theta$

Find the area of the surface generated by revolving the graph of the equation about the polar axis

$\frac{128\pi}{5}$ (35) $r = 2 + 2\cos\theta$

$4\pi^2 a^2$ (37) $r = 2a\sin\theta$

$$\boxed{S = \int_{\theta_1}^{\theta_2} 2\pi r \sin\theta \underbrace{\sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2}\, d\theta}_{ds}}$$