

Solutions

①

Q1 a) $\frac{x+y}{2} + x$ b) $e^{\frac{1}{2}x^3} \cdot \frac{1}{2}x^2$ c) $\frac{2a}{5c} + \frac{a-b}{c}$

Q2 a) $\frac{1}{26}$ b) $\frac{2}{13}$ c) domain error, can't raise integer to negative power

$1/\sqrt{13}$ check by squaring

Q3 $f(x) = 12\sin(2x) - 5x + 200$

plot(f, -200, 200), etc

fzeros(f, 30, 45) 39.3969, 41.0723, 41.9406

Q4 $f(x) = -\pi < x < \pi$? $\sin(x) : 0$

plot(f, -5, 5)

Q5 $f(x) = (\cos(5x^2) - 1) / \sin(4x)^4$

limit(f, 0)

$-25/512$

Q6 $f(x) = 15\sin(x) * \exp(-x^2/4) - x - 5$

plot(f, D(f), -10, 10)

fzeros(D(f), -5, 5)

$-1.02146, 1.02146$

Q7 ~~f(x)~~ $f_p(x) = 4\sin(x) + x/2$

plot(f_p, -15, 15)

fzeros(f_p, -10, 10)

$-5.52145, -3.60972, 0, 3.60972, 5.52145$

plot(D(f_p), -10, 10)

fzeros(D(f_p), -3, 3)

$-1.69612, +1.69612$

concave up $[-1.69612, +1.69612] + 2\pi n$ translates
concave down $[+1.69612, 4.58706] + 2\pi n$ translates

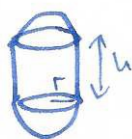
Q8 $f(x) = 20 \sin(x) / (x^2 - x + 1) + 2$

plot(f, -20, 20) etc

newton(f, D(f), -2) -2.20398

newton(f, D(f), -0.1) -0.11279

Q9



$$V = \pi r^2 h + \frac{4}{3} \pi r^3 = 500 \Rightarrow h = (500 - \frac{4}{3} \pi r^3) / \pi r^2$$

$$A = 2\pi r h + 4\pi r^2 = \frac{2\pi r (500 - \frac{4}{3} \pi r^3)}{\pi r^2} + 4\pi r^2$$

plot(A, 0, 100)

fzeros(D(A), 1, 20)

r = 4.92373 $\Rightarrow$ A = 304.65

Q10

$f(x) = 4 \exp(-2x^2)$

float(integrate(f, 2, 4)) 0.0015878

float(integrate($\pi f(x)$, $x \rightarrow \pi x f(x)^2$, 2, 4)) 3.43393×10^{-5}