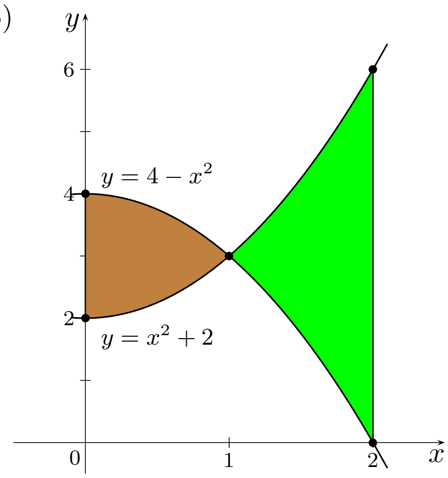
(1) $\dfrac{dy}{dx} = \dfrac{2\arctan x}{1+x^2} + \dfrac{x}{1+x^2} + \arctan x - \dfrac{1}{2\sqrt{x}\sqrt{x}\sqrt{x-1}}$; (2 a) 1 ; (2 b) $e^{2/3}$

(3 a) $\dfrac{3^{\sqrt{x}+2\ln x}}{\ln 3} + C$; (3 b) $\frac{1}{5}\sec^5(\ln x) - \frac{1}{3}\sec^3(\ln x) + C$; (3 c) $\frac{1}{4}(2x-1)^{1/2} + \frac{5}{6}(2x-1)^{3/2} + C$

(3 d) $\frac{3}{2}\ln|x| - \frac{1}{4}\ln\left(x^2+2\right) + C$; (3 e) $-\frac{1}{5}e^{2x}\cos 4x + \frac{1}{10}e^{2x}\sin 4x + C$; (3 f) $\frac{1}{108}\left(\frac{\pi}{2}+1\right)$

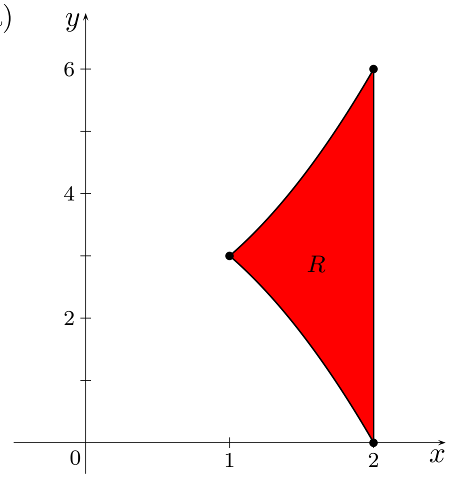
(4 a) converges to π ; (4 b) converges to π

(5)



A=4 square units

(6a)



(6b i) $\int_1^2 2\pi(x-1)(2x^2-2)\,dx$

(6b ii) $\int_1^2 \pi(12x^2-12)\,dx$

(7) $y = e^{-1+\sqrt{1-x^2}}$

(8 a) 0 ; (8 b) 0 ; (8 c) diverges

(9 a) $-\dfrac{\pi}{6}$; (9 b) $\dfrac{e}{e+1}$

(10 a) divergent by nTT ; (10 b) convergent by Root Test ; (10 c) divergent by LCT with $\sum \dfrac{1}{n}$

(10 d) convergent by Ratio Test

(11 a) absolutely convergent by DCT with $\sum \dfrac{1}{n^3}$

(11 b) convergent by AST but divergent by Integral Test, then the series is conditionally convergent

(12) interval of convergence: $(-\infty,\infty)$; (13a i) $\dfrac{\pi}{4}$; (13a ii) $\dfrac{\sqrt{3}}{2}$

(13 b) $\displaystyle\sum_{n=0}^{\infty}(-2)^n\,\frac{x^{n+1}}{n!}$; interval of convergence: $(-\infty,\infty)$

(14 a) $x - \frac{1}{2}x^2 + \frac{1}{3}x^3 - \frac{1}{4}x^4 + \frac{1}{5}x^5 \ldots$; (14 b) $\displaystyle\sum_{n=1}^{\infty}(-1)^{n+1}\,\frac{x^n}{n}$; (14 c) $r = 1$