1. $\displaystyle\int_1^2 x^3 \ln x \, dx$

$4\ln 2 - \dfrac{15}{16} + C$

2. $T(t) = \dfrac{100}{t^2}$ $t = 1 \to \infty$

∞ X 5

3. $5/4$

4. Arc length $\dfrac{x^3}{6} + \dfrac{1}{2x}$ $14/3$

5. $\sim 1/16$

6. $r = -8\cos\theta$

   Circle at center $(4, 0)$ $r = 4$

1. $\dfrac{512}{21}\pi$

2.

3. $\dfrac{1}{2}\ln|2x^2+1| + \ln|x-1| + C$

4. $\ln\left|\dfrac{x}{3} + \dfrac{\sqrt{x^2-9}}{3}\right| + C$

5.   18   X

$$\sqrt{9\sin^2 t + 9\cos^2 t}$$

$$= \sqrt{9(1)}$$

$$= \sqrt{9}$$

$$2\int_0^{\pi} 3 \, dt =$$

$$= 3t \Big|_0^{\pi}$$

$$= 3\pi - 3(0)$$

$$= 3\pi$$

$$\int_3$$

$$\frac{3x}{2x^2 - x - 1} = \frac{A}{2x+1} + \frac{B}{x-1}$$

$$2x^2 - x - 1$$

$$a = 2, \quad b = -1, \quad c = -1$$

$$x = \frac{-(-1) \pm \sqrt{1 - 4(2)(-1)}}{2(2)}$$

$$= \frac{1 \pm \sqrt{1+8}}{4}$$

$$= \frac{1 \pm 3}{4}$$

$$x = 1 \quad OR \quad x = -\frac{1}{2}$$

$$(x-1)\left(x+\frac{1}{2}\right) = 0$$

$$\frac{A}{x-1} + \frac{B}{x+1/2} = \frac{3x}{}$$

$$A\left(x + \frac{1}{2}\right) + B(x-1) = 3x$$

$$\boxed{\begin{aligned} x^2 + \frac{1}{2}x - x - \frac{1}{2} &= 0 \\ 2\left(x^2 - \frac{1}{2}x - \frac{1}{2} = 0\right) \\ 2x^2 - x - 1 &= 0 \end{aligned}}$$

@ x=1

$\frac{3A}{2} = 3$

$\boxed{A = 2}$

@ x= -1/2

$-\frac{B}{2} = -\frac{B}{2}$

$\boxed{B = 1}$

$An + \frac{A}{2} + Bn - B = 3n$

$n(A+B) + \left(\frac{A}{2} - B\right) = 3n$

$\frac{A}{2} - B = 0$

$\frac{A}{2} = B$

$A = 2B \qquad \Rightarrow 2$

$A + B = 3$

$2B + B = 3$

$3B = 3$

$B = 1$

$\int \frac{2}{x-1} + \frac{1}{x+1/2}$

$\boxed{2 \ln|x-1| + \ln|x+1/2|}$

let x = 10

$\frac{1}{2} \ln|2n+1| + \ln|n-1| + c$

$2\ln|9| + \ln|10.5| = 6.74582$

$\frac{1}{2} \ln|2(10)+1| + \ln|9| = 3.71948$

$\boxed{\frac{1}{2} \ln|n| = \ln|n^{1/2}|}$

$\ln \left| \boxed{\sqrt{2n+1} \, (n-1)} \right|$

$2 \ln|n-1| + \ln|n+1/2|$

$\ln|n^2 - n + 1| + \ln|n + 1/2|$

$\ln|(n^2 - n + 1)(n + 1/2)|$

$? \left| n^3 + \frac{n^2}{2} - n^2 - \frac{x}{2} + n + \frac{1}{2} \right|$

$\boxed{= \left| n^3 - \frac{n^2}{2} + \frac{n}{2} + \frac{1}{2} \right|}$