

1. (7 points) Find the following indefinite integrals:

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

ANS: Take $u = x^2 - 4$ to get $\int \frac{u+4}{u} \frac{1}{2} du = \frac{1}{2}u + 2 \ln |u| + C = \frac{1}{2}(x^2 - 4) + 2 \ln |x^2 - 4| + C$.

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

ANS: Direct substitution does not work. Try partial fractions. Divide: $\frac{x^2}{x^2-4} = 1 + \frac{4}{x^2-4}$.

Factor: $x^2 - 4 = (x + 2)(x - 2)$.

Form: $\frac{4}{x^2-4} = \frac{A}{x+2} + \frac{B}{x-2}$.

Find the parameters: $A = -1$ and $B = 1$.

Answer: $x - \ln |x + 2| + \ln |x - 2| + C = x + \ln \left| \frac{x-2}{x+2} \right| + C$.

(c) (2 points) $\int \frac{x^2}{x^2+4} dx$

ANS: Direct substitution does not work. Try partial fractions. Divide: $\frac{x^2}{x^2+4} = 1 - \frac{4}{x^2+4}$.

Denominator does not factor so can not be simplified further.

Use inverse trig with triangle having hypotenuse $\sqrt{x^2 + 4}$ and legs x and 2 . This gives $x - 2 \arctan\left(\frac{x}{2}\right) + C$.

2. (3 points) Use Simpson's rule to estimate the distance a particle travels from time $t = 0$ to time $t = 80$ seconds if you know the velocity in feet per second at each of the following times:

time	0	10	20	30	40	50	60	70	80
velocity	3	10	7	4	3	2	0	-1	3

Please do not simplify your answer; leave it as a long sum.

ANS: $\frac{10}{3}[3 + 40 + 14 + 16 + 6 + 8 + 0 - 4 + 3]$ feet.