

NORTHERN ILLINOIS UNIVERSITY

PHYSICS DEPARTMENT

Physics 284 – Modern Physics

Spring 2024

Problem Set #1

Problem Set Due: Thurs., Jan. 25, 2024

Read Krane Chapter 2

Chapter 2:

1. Krane Problem 3 Draw picture

Also for this problem: prove that, to third order for x near 0, the Taylor series expansion of $1 / (1 + x^2)$ is:

$$\frac{1}{1 + x^2} \approx 1 - x^2 + x^4 + \dots$$

Use the relation that the Taylor series expansion of $f(x)$ for x near a is

$$f(x) = f(a) + f'(a)(x - a) + \frac{1}{2!}f''(a)(x - a)^2 + \frac{1}{3!}f'''(a)(x - a)^3 + \dots$$

(see Winkepedia: [Google Taylor Series expansion](#))

2. Krane Problem 4 Draw picture (show reference frames)

Also for this problem: prove that, to third order for x near 0, the Taylor series expansion of $\sqrt{1 + x^2}$ is:

$$\sqrt{1 + x^2} \approx 1 + \frac{x^2}{2} - \frac{x^4}{8} + \dots$$

3. Krane Problem 6 Draw picture (show reference frames)

4. Krane Problem 32 Just show derivation

5. Krane Problem 44 Draw picture (show reference frames)

6. OpenStax University Physics Vol. 2: Section 16.2: Problem 43

7. OpenStax University Physics Vol. 2: Section 16.2: Problem 45

8. OpenStax University Physics Vol. 3: Section 3.2: Problem 28