

Pre-Semester Physics - Exercises Summer 2009

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1. Exercise

Differentiate the following functions with respect to the arguments:

$$a) f(x) = \frac{1}{3}x^3 + 7x \quad b) g(y) = e^{-\lambda y} \quad c) h(z) = \alpha \cos(\beta z)$$

2. Exercise

Calculate the following definite and indefinite integrals:

$$a) \int_{-2}^2 (x + x^3) dx \quad b) \int 5e^{5x} dx \quad c) \int a \cos(\omega t) dt$$

3. Exercise

Sketch the following functions:

$$a) f(x) = -x^2 + x^3 \quad b) g(x) = \cos(2x) \quad c) h(x) = e^{-x} \cos(x)$$

4. Exercise

Calculate the following scalar product and vector product:

$$a) \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} \cdot \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix} \quad b) \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} \times \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix}$$

5. Exercise

Draw the vector $\vec{a} \in \mathbb{R}^2$ and sketch the path $\vec{x}(t) : [0, \pi] \rightarrow \mathbb{R}^2$:

$$a) \vec{a} = \begin{pmatrix} -2 \\ 2 \end{pmatrix} \quad b) \vec{x}(t) = \begin{pmatrix} \cos(t) \\ \sin(t) \end{pmatrix}$$

6. Exercise

A pizza for two persons has a certain diameter d . What diameter is needed, if four persons want to share the pizza?

7. Exercise

What is the force of a spring with spring constant D , if it is elongated from its rest position at $x = 0$ to x ?

8. Exercise

Assume now a mass point with mass m attached to the spring. Newton's second law states $F = m\ddot{x}$. Write down the equation of motion for the force found in exercise 7 and give the (general) solution.