

## Pre-Semester Physics - Solutions Summer 2009

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**1. Exercise**

Differentiate the following functions with respect to the arguments:

$$a) f'(x) = x^2 + 7 \quad b) g'(y) = \lambda e^{-\lambda y} \quad c) h(z) = -\beta\alpha \sin(\beta z)$$

**2. Exercise**

Calculate the following definite integrals and anti-derivatives

$$a) 0 \quad b) e^{5x} \quad c) \frac{1}{\omega} a \sin(\omega t)$$

**3. Exercise****4. Exercise**

Calculate the following scalar product and vector product:

$$a) \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} \cdot \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix} = 10 \quad b) \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} \times \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix} = \begin{pmatrix} -4 \\ 8 \\ -4 \end{pmatrix}$$

**5. Exercise****6. Exercise**

It is  $d/2 = r$ . Since  $A = \pi r^2$  and  $A' = 2A = \pi r'^2$  it is

$$2\pi r^2 = \pi r'^2 \quad \Leftrightarrow \quad r' = \sqrt{2}r$$

**7. Exercise**

$$F = -Dx$$

**8. Exercise**

$$m\ddot{x} + Dx = 0 \quad \Leftrightarrow \quad \ddot{x} + \omega^2 x = 0$$

with  $\omega^2 = \frac{D}{m}$ . General solution

$$x(t) = A \sin(\omega t + \phi)$$