Physics 390: Math Quiz

These questions will not be graded. They are for your own practice. You are not expected to hand them in. You can look stuff up in books or on the web. Solutions next week.

1. Exponents:

$$x^a \times x^b = \qquad\qquad (x^a)^b =$$

2. Trig functions:

$$\sin^2\theta + \cos^2\theta = \qquad\qquad \cos(\alpha+\beta) =$$

3. Derivatives and integrals of powers:

$$\frac{\mathrm{d}}{\mathrm{d}x}(x^a) = \qquad\qquad \int x^a\,\mathrm{d}x =$$

4. Derivatives and integrals of logs and exponentials:

$$\frac{\mathrm{d}}{\mathrm{d}x}\mathrm{e}^{ax} = \qquad\qquad \int \mathrm{e}^{ax}\,\mathrm{d}x =$$
$$\frac{\mathrm{d}}{\mathrm{d}x}\ln x = \qquad\qquad \int \ln x\,\mathrm{d}x =$$

5. Derivatives and integrals of trig functions:

$$\frac{\mathrm{d}}{\mathrm{d}\theta}\sin\theta = \qquad\qquad \int \sin\theta\,\mathrm{d}\theta =$$
$$\frac{\mathrm{d}}{\mathrm{d}\theta}\cos\theta = \qquad\qquad \int \cos\theta\,\mathrm{d}\theta =$$

6. The product rule:

$$\frac{\mathrm{d}}{\mathrm{d}x}\Big[f(x)g(x)\Big] =$$

7. The chain rule:

$$\frac{\mathrm{d}}{\mathrm{d}x}\Big[f(g(x))\Big] = \qquad\qquad \frac{\mathrm{d}}{\mathrm{d}\theta}\cos(\theta^2) =$$

See over →

8. The fundamental theorem of calculus:

$$\int_a^b \left(\frac{\mathrm{d}f}{\mathrm{d}x}\right) \mathrm{d}x =$$

9. Implicit differentiation: If $x\mathrm{e}^x + y\mathrm{e}^y = 1$ find

$$\frac{\mathrm{d}y}{\mathrm{d}x} =$$

in terms of x and y.

10. Integration by parts:

$$\int_a^b f(x)\frac{\mathrm{d}g}{\mathrm{d}x}\,\mathrm{d}x = \qquad\qquad \int_0^\infty x\mathrm{e}^{-x}\,\mathrm{d}x =$$

11. Taylor expansion:

$$f(x_0 + \epsilon) = \sum_{n=0}^{\infty} \Big[\qquad\qquad \Big] \epsilon^n.$$

12. Partial derivatives: If $\phi(x, y, z) = x^2y^3z$ then

$$\frac{\partial \phi}{\partial x} =$$
$$\frac{\partial \phi}{\partial y} =$$
$$\frac{\partial \phi}{\partial z} =$$

13. Gradient: If $\phi(x, y, z) = x^2y^3z$ as above, then

$$\nabla\phi =$$

14. Divergence: If $\mathbf{A} = 2x\,\hat{\mathbf{i}} + 3y\,\hat{\mathbf{j}} + 5z\,\hat{\mathbf{k}}$, where $\hat{\mathbf{i}}$, $\hat{\mathbf{j}}$, and $\hat{\mathbf{k}}$ are unit vectors in the x, y, and z directions respectively, then

$$\nabla \cdot \mathbf{A} =$$

15. Curl: If $\mathbf{B} = 7z\,\hat{\mathbf{i}} + 2x\,\hat{\mathbf{j}} + 11y\,\hat{\mathbf{k}}$ then

$$\nabla \times \mathbf{B} =$$