

Mathematics Knowledge Survey

The Physical Sciences are indisputably quantitative. However, the mathematical background of students entering this class is likely to be quite varied – no matter what the formal prerequisites may be.

This is a survey to evaluate what mathematics knowledge you currently know. I am very confident that nobody in the room will get all of these problems wrong or right. Your *performance* will not affect your course grade, but I will note participation and effort. I am merely trying to find out the level of your previous mathematical knowledge so I know when I have to take a little more time and go through the mathematics in more detail. It is in your best interest to try on this exam; if you understate your mathematics knowledge, you will be bored mindless in some of the math review. If you use online sources or other materials to boost your score, then I'll assume you have the mathematics knowledge that you have demonstrated on this survey, and you may be quickly lost.

Do the best you can. Don't worry if you can't do anything past the first page – it is better we find out this way rather than I start putting stuff on the board you don't understand. The problems tend to get harder the further you move through the survey.

- ▶ What is your name, major, and year? What is the most advanced mathematics class you have taken?
- ▶ Solve for x : $(3 \times 0) + 4 = x$
- ▶ Solve for x : $3 \times (0 + 4) = x$
- ▶ Solve for x : $6x + 7 = 55$
- ▶ Solve for x : $6(x + 7) = 54$

1. Simplify: $\sqrt{121a^2b^4c^5}$
2. Evaluate: $\sqrt{-144}$
3. Evaluate: $\sqrt[3]{-27}$
4. Evaluate: $64^{\left(\frac{1}{4}\right)}$
5. Expand: $(a - 2b)^2$

- ▶ Put the following 10 numbers in order from largest to smallest: the number of seconds in a year, the number of molecules in a mole,
 $\pi, 3 \times 10^4, 7 \times 10^{-3}, -1, 0, 2 \times 10^{17}, 5^3, \frac{1}{100}$.
- ▶ What is $\ln[e^\pi]$?
- ▶ Find $\lim_{x \rightarrow 0} \left[\frac{\sin x}{x} \right]$
- ▶ Calculate: $\frac{d}{dx} [3x^5]$
- ▶ Calculate: $\frac{\partial}{\partial y} [4x^4/y^3]$

- a Integrate $\int x^2 dx$
- b Integrate $\int_0^1 x \exp(-x^2) dx$
- c What is the magnitude of the following vector?
 $\langle 3, 4, -12 \rangle$
- d Write the vector $\langle 3, 4, 12 \rangle$ in spherical coordinates.
- e Evaluate the following: $\langle 7, 0, 6 \rangle \cdot \langle 3, 2, 1 \rangle$
- f Evaluate the following: $\langle 7, 0, 6 \rangle \times \langle 3, 2, 1 \rangle$
- g Evaluate the following: $\underline{\nabla} [5x^2y - \sin(xz) + 17]$
- h Evaluate the following: $\underline{\nabla} \cdot \langle 4xz, 3yz, 4 \rangle$
- i Evaluate the following: $\underline{\nabla} \times \langle 4xz, 3yz, 4 \rangle$

- ▶ Solve the following subject to the boundary conditions $u(t, 0) = 0$ and $u(t, L) = 0$. (The initial conditions will remain unspecified).

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$$

- ▶ Evaluate the following: $\nabla^2 [5r^2\phi\theta - 3\theta^2 \sin \phi + 10r - 6]$