

Preliminary Math Self-Assessment

Physics 141

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The following self-assessment is an opportunity for you to determine if you should review some basic math skills that are essential for success in Introductory Physics I. Please complete the questions below without using any resources except or a calculator. Estimate your answers when you need to. You do not need to time yourself. I will not collect this assessment, but I expect a hard copy of your completed assessment to be in your class binder throughout the quarter.

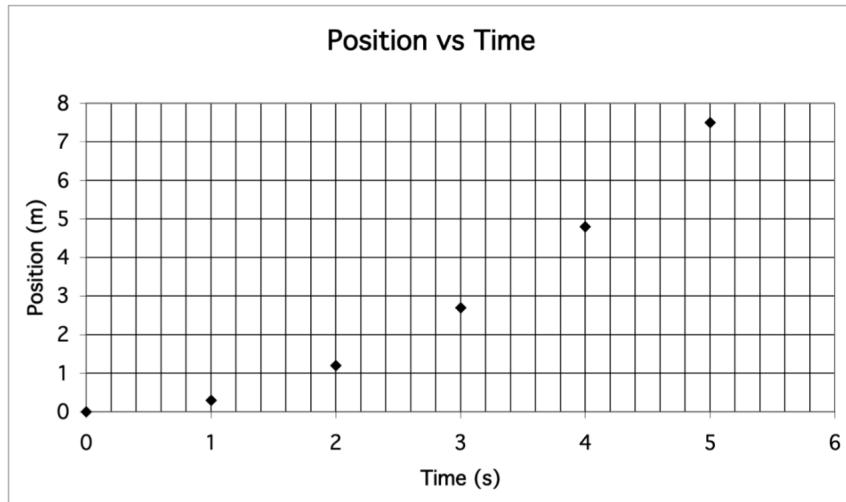
Use the space below each problem to show your work clearly; showing your work clearly is essential to your success in this class. Further, if you make an error, showing your work clearly allows you to find your error and correct your understanding more efficiently.

ONLY AFTER you've completed the assessment, compare your answers to the solution key provided. Questions that you missed should be followed up by reviewing relevant concepts and practicing problems in any algebra or pre-calculus textbook. Reading my solutions and convincing yourself you now understand how to solve the problem does not qualify as reviewing the material.

Note that an understanding of physics is not necessary to answer any of the following questions.

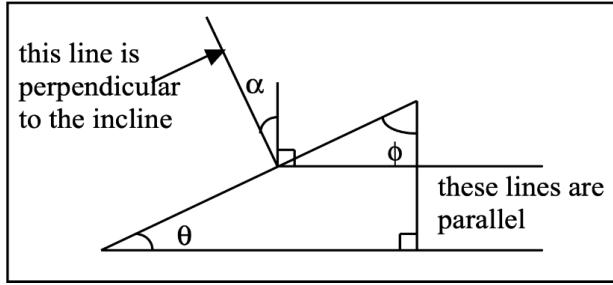
1. $(4^3)(4^5) =$
2. A circle's area is given by $A = \pi r^2$, where r is the radius. Two circles have different radii, r_1 and r_2 , with corresponding areas A_1 and A_2 . Find A_2 if $A_1 = 6 \text{ m}^2$ and $r_2 = 2r_1$.
3. $\frac{30}{4} \times \frac{2}{5} =$
4. Several measurements are made of students' heights. What is the average height? Measured heights (in meters): 1.6, 1.8, 1.75, 2.1, 1.65, 1.8, 1.9.
5. An angle is measured to be $2\frac{1}{4}$ radians. Find $\cos(\theta)$.

6. A relationship between position and time, $x(t) = bt^2$, is shown in the scatter plot. Estimate b from the data. Do not forget units.



7. How many seconds are in one year?
8. Express your results for the following in scientific notation:
$$\frac{(2.3 \times 10^{20})(3.8 \times 10^{-15})}{(8 \times 10^8)}$$
9. Evaluate $e^{-2.4}$.

10. For the picture shown, find ϕ and α in terms of θ .



11. Find $\ln(f)$ given $f = I/I_0$ and $I = 6I_0$.
12. Evaluate $\frac{1}{2} + \frac{1}{5}$.
13. Sketch $y(t) = 3t + 2$, where y is in meters and t is in seconds. Be sure your axes include scales, labels, and units.
14. Find F and a if $F - 6a = 20$ and $-F + 8a = 0$.
15. Evaluate $\frac{2}{5} + \frac{7}{10}$.
16. $\frac{1}{2} + \frac{1}{5} =$
17. Find $a/b + c/d$ when $b = 3d$, $a = 6c$, and $c = 2d$.
18. Given $\frac{1}{f} = \frac{1}{s} + \frac{1}{d}$, solve for d in terms of f and s .
19. For the triangle shown, $a = 3$ m and $c = 5$ m. Find b , $\sin(\theta)$, and $\tan(\theta)$.
20. Given $F_y L - MgL/2 + (2M)gL/3 = 0$, find an expression for F_y in terms of M , g , and L .
21. Given $\frac{GMm}{x^2} = \frac{GMm}{(d-x)^2}$, determine an expression for x in terms of M , m , G , and d .
22. A drawer contains 9 red socks and 11 blue socks. It is dark and you are trying to grab a matching pair. How many socks do you need to take out to be sure of a matching pair?
23. For certain charges, the electric field is given by $E(x) = b/x^2$. At the location x_0 , $E(x_0) = E_0$. Find $E(x)$ for $x = 4x_0$ in terms of E_0 .
24. Given $2I_1 + 2I_2 - 5 = 0$ and $I_1 - 4I_2 = 0$, find I_1 and I_2 .
25. Given $-T + Mg = Ma$ and $T - mg = ma$, solve for a in terms of M , m , and g .
26. Sketch the following three functions on the same graph where $0 \leq t \leq 2\pi$: $x(t) = \cos t$, $x(t) = 2 \cos t$, and $x(t) = \sin(2t)$.
27. What are the following conversions?
- (a) 57 g to kg

- (b) 10 m to mm
(c) 3 mm² to m²
28. Sketch the following three functions on the same graph where $-2 \leq x \leq 2$: $y(x) = x$, $y(x) = |x|$, and $y(x) = 3x$.
29. On one graph, roughly sketch the behavior of the following two functions, where p and V are positive: $p(V) = 1/V$ and $p(V) = 1/V^2$.
30. Evaluate $\sin\left(\frac{2\pi}{3}t\right)$ for $t = 0, 1, 3$.
31. Evaluate $A \sin(kx - \omega t)$ for:
(a) $x = 0$ m, $t = 0$ s
(b) $x = 1$ m, $t = 0.25$ s

Given $A = 2$ cm, $k = 4\pi$ rad/m, and $\omega = 20\pi$ rad/s.

32. Consider the equation $pV = nRT$. If n and R are constant, how does V change if you both double p and quadruple T ?
33. Solve the following for T_f in terms of the m 's, c 's, and T 's:
- $$m_1c_1(T_f - T_{1i}) + m_2c_2(T_f - T_{2i}) = 0.$$
34. Using your previous result and $c_1 = c_2$, $m_2 = 2m_1$, $T_{1i} = 50^\circ\text{C}$, and $T_{2i} = 80^\circ\text{C}$, find T_f .
35. Refer to the figure shown. What is $\Delta r = r_2 - r_1$ in terms of h and D if each r_i is the distance from the corresponding circle to the box? Assume the lines labeled h and D are perpendicular.