

CPS lesson
Introduction
ANSWER KEY

1. Use dimensional analysis to figure out which equation could represent a force.
F = force, m = mass, v = speed, r = position

* A. $F = mv^2/r$

B. $F = mvr$

C. $F = mv^2/2$

D. $F = mv$

2. Which of the following is currently a standard in the SI system?

A. The length of a steel rod in Paris, France.

B. The period of a one-meter pendulum.

C. The mass of a platinum-iridium cylinder in Washington, DC.

* D. The period of vibration of light from a cesium isotope.

E. One ten-millionth of the distance from the equator to a pole.

3. A rectangle is measured to have a length of 22.4 ± 0.4 cm and a width of 14.2 ± 1.2 cm. Its area in cm^2 is:

A. 318 ± 0.8

B. 318 ± 1.6

C. 318 ± 28

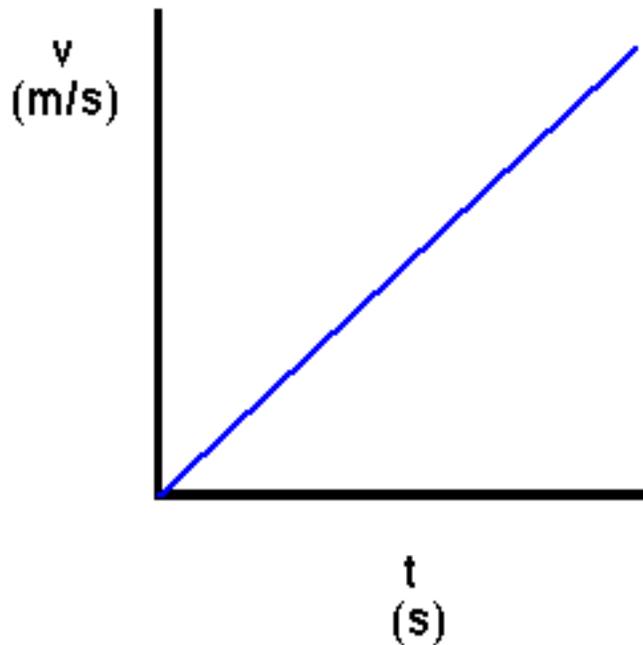
* D. 318 ± 33

E. 318 ± 48

4. What is the approximate volume of the Sears Tower?

- * A. $2.5 \times 10^8 \text{ ft}^3$
- B. $2.5 \times 10^8 \text{ mi}^3$
- C. $2.5 \times 10^8 \text{ yd}^3$
- D. $2.5 \times 10^8 \text{ cm}^3$

5. What are the units of the slope of the line below?



- A. m/s
- * B. m/s^2
- C. m

D. s

E. no units

6. Exercise in vector magnitudes.

\vec{v}_a , \vec{v}_b , and \vec{v}_c represent **velocities**.

$$\vec{v}_a = (6\hat{x} + 3\hat{y}) \text{ m/s}$$

$$\vec{v}_b = (3\hat{x} + 6\hat{y}) \text{ m/s}$$

$$\vec{v}_c = 2(\vec{v}_a + \vec{v}_b) \text{ m/s}$$

The **magnitude** of \vec{v}_c is?

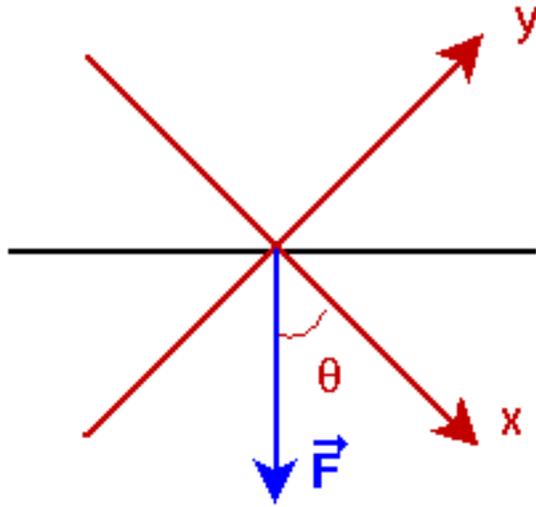
A. 9 m/s

B. 18 m/s

C. $6 \times 2^{1/2}$ m/s

* D. $18 \times 2^{1/2}$ m/s

7. Find the x and y components of this force vector:



A.

$$\vec{F}_a = F_a \hat{x}$$

B.

$$\vec{F}_a = F_a \hat{x} + F_a \hat{y}$$

C.

$$\vec{F}_a = F_a \sin(\theta) \hat{x} - F_a \cos(\theta) \hat{y}$$

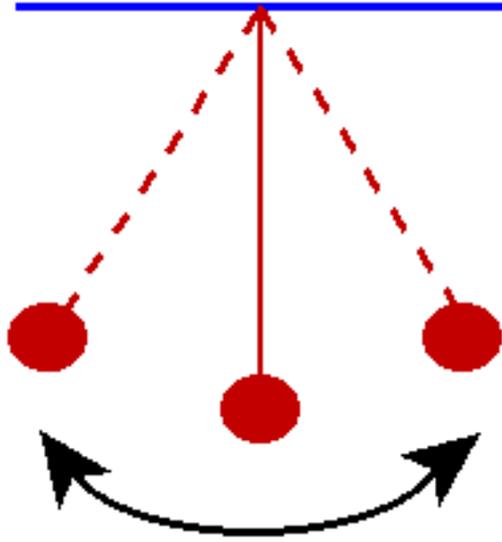
* D.

$$\vec{F}_a = F_a \cos(\theta) \hat{x} - F_a \sin(\theta) \hat{y}$$

8. Which of the following has the right dimensions to be the period of this pendulum?

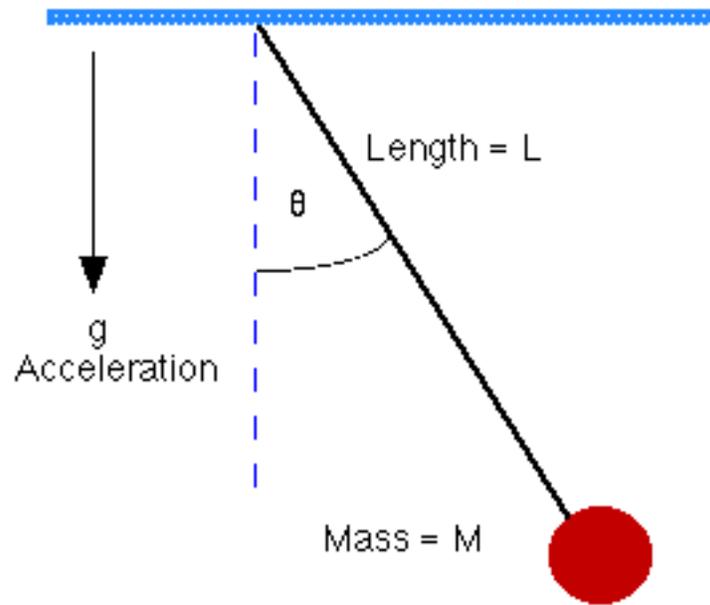
$$g = 9.8 \text{ m/s}^2$$

$$L = 1 \text{ m}$$



- * A. $(L/g)^{1/2}$
B. L/g
C. g/L
D. $(g/L)^{1/2}$

9. Which of the following functions of L and g have dimensions of time?



- A. L/g
- B. Lg
- C. g/L
- * D. $(L/g)^{1/2}$
- E. $(Lg)^{1/2}$

10. Which of the following numbers has 3 significant digits?

(1) 4.15 (2) 0.0415 (3) 4.15×10^5 (4) 0.415

- A. 1 only
- B. 2 only
- C. 3 only
- D. 4 only
- * E. all of them

11. You measure a rectangle to have a length of 23.54 cm and a width of 2.75 cm. What is its area in cm^2 ?

A. 64.7350

* B. 64.7

C. 64.74

D. 65

12. Consider Newton's second law $F = ma$, where force is in N if masses are expressed in kg, lengths in m, and times in s. Therefore what is a newton in SI units?

A. kg m/s

B. kg/s

* C. kg m/s^2

D. m/s^2

E. kg m

13.

If A and B are vectors and S is a scalar, which of these is a vector?

1. $\vec{A} + \vec{B}$

2. $s\vec{A}$

3. $\vec{A} \cdot \vec{B}$

4. $\vec{A} \times \vec{B}$

- A. only one of them
- B. exactly two of them
- * C. exactly three of them
- D. all of them

14. Which of the following statements is true?

- 1. A scalar multiplied by a vector is a vector.
- 2. A scalar can have units.
- 3. A vector can have units.
- 4. You cannot add a scalar and a vector.

- A. none of them
- B. exactly one of them
- C. exactly two of them
- D. exactly three of them
- * E. all of them

15. Which of the following is not a proper way to write a vector?

* A.

$$\vec{A} = A_x + A_y$$

B.

$$\vec{A} = 6\hat{x} + 7\hat{y}$$

C.

$$\vec{B} = B_x \hat{i}$$

D.

$$\vec{C} = \vec{A} + \vec{B}$$

E.

$$\vec{D} = -15 \text{ m/s}^2 \hat{j} + 6 \text{ m/s}^2 \hat{k}$$

16. The three base SI units in classical mechanics are:

A. foot, pound, second

B. mass, length, time

* C. meter, kilogram, second

D. newton, kilogram, second

E. centimeter, gram, second

17. Which of the following best expresses the statement, "The mass of an object equals 5130 grams."

A. $m = 5130$

B. 5.13 kg

C. $x = 5130 \text{ g}$

* D. $m = 5.13 \text{ kg}$

18. Equality of two vectors means:

1. Each of their corresponding components are equal.
2. They have the same direction.
3. Their magnitudes are equal.
4. Their dot product is zero.
5. Nothing. Vectors cannot be mathematically equated.

A. only 1

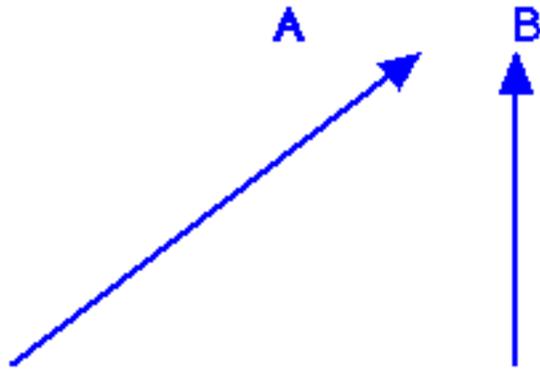
B. only 2 and 3

* C. only 1, 2, and 3

D. only 4

E. only 5

19. For the two vectors at right, which result best represents $B - A$?



A.



* B.



C.



D.

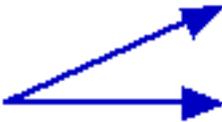


20. Choose the pair of vectors which has the largest dot product.

A.



B.



* C.



21. Suppose that the sum of two vectors A and B is R .

Which statement is true about their magnitudes?

A. R is always equal to $A+B$.

B. R can never be equal to $A+B$.

C. R can either be equal to or greater than $A+B$.

* D. R can either be equal to or smaller than $A+B$.

E. R can be equal to, greater than, or smaller than $A+B$.

22. Which of the following describes a 3D vector?

1. (x,y,z) 2. (r,q,f) 3. 100 km at 270° 4. (r,f,z)

A. only 1

B. 1 and 2

* C. 1,2, and 4

D. all of them

E. none of them