Name:_____ Class:_____ Date:_____

Chapter 01

1. Since 1983 the standard meter has been defined in terms of which of the following?

    a. specific alloy bar housed at Sevres, France

    b. wavelength of light emitted by krypton-86

    c. distance from the Earth's equator to the North Pole

    d. the distance light travels in a certain fraction of a second

    e. None of the above

ANSWER: d

2. Since 1967 the standard definition for the second has been based on which of the following?

    a. characteristic frequency of the cesium-133 atom

    b. average solar day

    c. sidereal day

    d. Greenwich Civil Time

    e. None of the above

ANSWER: a

3. In mechanics, physicists use three basic quantities to derive additional quantities. Mass is one of the three quantities. What are the other two?

    a. length and force

    b. power and force

    c. length and time

    d. force and time

ANSWER: c

4. The prefixes which are abbreviated f, d, and T represent which of the following?

    a. 10^{-30}, 10^{-2}, and 10^{24}

    b. 10^{-15}, 10^{2}, and 10^{24}

    c. 10^{-15}, 10^{-1}, and 10^{12}

    d. 10^{-13}, 10^{2}, and 10^{24}

    e. 10^{-30}, 10^{-1}, and 10^{-2}

ANSWER: c

5. The ratio T/m of the prefixes M and m has what value?

    a. 10^{16}

    b. 10^{14}

    c. 10^{15}

    d. 10^{13}

    e. 10^{17}

ANSWER: c

6. The nuclei of atoms contain

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    a. electrons only.

    b. neutrons only.

    c. protons and electrons.

    d. protons and neutrons.

ANSWER: d

7. When was the existence of the neutron confirmed?

    a. in ancient times

    b. in 1895

    c. in 1932

    d. in 1969

ANSWER: c

8. The proton contains which of the following combination of quarks?

    a. two up quarks and one down quark

    b. one up quark and two down quarks

    c. one top quark and two bottom quarks

    d. two top quarks and one bottom quark

ANSWER: a

9. Which formula is dimensionally consistent with an expression yielding a value for velocity? (*a* is acceleration, *x* is distance, and *t* is time)

    a. v/t^2

    b. vx^2

    c. v^2/t

    d. *at*

ANSWER: d

10. Which expression is dimensionally consistent with an expression that would yield a value for time^{-1}? (*v* is velocity, *x* is distance, and *t* is time)

    a. *v/x*

    b. v^2/x

    c. *x/t*

    d. v^2t

ANSWER: a

11. If the displacement of an object, *x*, is related to velocity, *v*, according to the relation $x = Av$, the constant, *A*, has the dimension of which of the following?

    a. acceleration

    b. length

    c. time

    d. area

ANSWER: c

12. The speed of a boat is often given in knots. If a speed of 5 knots were expressed in the SI system of units, the units would be:

 a. m.

 b. s.

 c. m/s.

 d. kg/s.

ANSWER: c

13. If a is acceleration, v is velocity, x is position, and t is time, then which equation is not dimensionally correct?

 a. $t = x/v$

 b. $a = v^2/x$

 c. $v = a/t$

 d. $t^2 = 2x/a$

ANSWER: c

14. Suppose an equation relating position, x, to time, t, is given by $x = b\,t^3 + c\,t^4$, where b and c are constants. The dimensions of b and c are respectively:

 a. T^3, T^4.

 b. $1/T^3$, $1/T^4$.

 c. L/T^3, L/T^4.

 d. $L^2\square T^3$, $L^2\square T^4$.

ANSWER: c

15. Areas always have dimensions _____ while volumes always have dimensions _____.

 a. m^2, m^3

 b. L^2, L^3

 c. Both a and b are correct.

 d. No answer is correct because of the "always."

ANSWER: b

16. Which one of the choices below represents the preferred practice regarding significant figures when adding the following: $14.4 + 13 + 55.12 + 2.774$?

 a. 85.2940

 b. 85.294

 c. 85.29

 d. 85.3

 e. 85

ANSWER: e

17. Which one of the choices below represents the preferred practice regarding significant figures when multiplying the

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following: $15.0 \times 5.6 \times 2.33$?

    a. 200

    b. 195.720

    c. 195.72

    d. 195.7

    e. 196

ANSWER: e

18. Calculate $(0.73 + 0.071)(3.3 \times 10^3)$, keeping only significant figures.

    a. 2600

    b. 2643

    c. 2661

    d. 2419

    e. 3000

ANSWER: a

19. The length and width of a standard sheet of paper is measured, and then the area is found by calculation to be 91.50 in^2. The number of significant figures in the width measurement must be at least:

    a. 1.

    b. 2.

    c. 3.

    d. 4.

    e. 5

ANSWER: c

20. The number 0.03 has how many significant figures?

    a. 2

    b. 3

    c. 5

    d. 6

    e. 7

ANSWER: a

21. Multiplying a 2 significant figure number by a 4 significant figure number and then dividing the product by a seven significant figure number yields a number with how many significant figures?

    a. 6/7

    b. 1

    c. 2

    d. 13

    e. 8/7

ANSWER: c

22. Assume when using a meter stick measuring can be done so that the last significant figure is in the tenth of a

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millimeter digit. If you are measuring an object with length between 6 and 7 cm, how many significant figures will result if you only use the part of the meter stick between the 1-cm and 9-cm positions?

   a. 2
   b. 3
   c. 4
   d. 5
   e. more than 5

ANSWER: b

23. Assume when using a meter stick measuring can be done so that the last significant figure is in the tenth of a millimeter digit. If you are measuring an object with length between 8 and 9 cm, how many significant figures will result if you only use the part of the meter stick between the 82- and 93-cm positions?

   a. 0
   b. 2
   c. 3
   d. 4
   e. more than 4

ANSWER: c

24. Assume when using a meter stick measuring can be done so that the last significant figure is in the tenth of a millimeter digit. If you are measuring an object with length between 25 and 53 cm, how many significant figures will result if you only use the part of the meter stick between the 3- and 85-cm positions?

   a. 1
   b. 2
   c. 3
   d. 4
   e. more than 4

ANSWER: d

25. How many significant figures does the number 3 600 have?

   a. 1
   b. 2
   c. 3
   d. 4
   e. One cannot tell with certainty when the number is written in the given form, but it will be one of the other given answers.

ANSWER: e

26. In the text are the following conversion factors:
i. 1 mi = 1 609 m
ii. 1 m = 39.37 in.
iii. 1 ft = 30.48 cm
iv. 1 in. = 2.54 cm
The 1 on the left hand side is assumed to have the same number of significant figures as the number on the right hand side of each of these equations. However, 2 of these conversion factors are exact, and this means they have the equivalent of

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an unlimited number of significant figures when used in calculations. Which 2 are the exact conversion factors?

    a. i and ii

    b. i and iii

    c. ii and iii

    d. iii and iv

ANSWER: d

27. On planet Q the standard unit of volume is called the guppy. Space travelers from Earth have determined that one liter = 36.6 guppies. How many guppies are in 100 liters?

    a. 3,660 guppies

    b. 3,696.6 guppies

    c. 3,560 guppies

    d. 3,760 guppies

    e. 3,623.4 guppies

ANSWER: a

28. On planet Z, the standard unit of length is the foose. Ann the Astronaut is 5.80 feet tall on earth. She lands on planet Z and is measured to be 86 foosi tall. Her partner Rachael is 89 foosi tall. How tall is Rachael on Earth?

    a. 6.5 feet

    b. 6 feet

    c. 5.80 feet

    d. 5.7 feet

    e. 6.2 feet

ANSWER: b

29. A furlong is a distance of 180 yards. A fortnight is a time period of two weeks. A race horse is running at a speed of 7 yards per second. What is his speed in furlongs per fortnight?

    a. 47,040 furlongs/fortnight

    b. 6,720 furlongs/fortnight

    c. 47,140 furlongs/fortnight

    d. 47,340 furlongs/fortnight

    e. 46,840 furlongs/fortnight

ANSWER: a

30. A cereal box has the dimensions of 0.18 m × 0.24 m × 0.080 m. If there are 3.28 feet per meter, then what is the volume of the box in cubic feet?

    a. 0.12 cubic feet

    b. 0.04 cubic feet

    c. 0.42 cubic feet

    d. 0.0113 cubic feet

    e. 0.021 cubic feet

ANSWER: a

31. The distance to the Andromeda Galaxy is estimated at about 2×10^6 light years. A light year is the distance traveled by light in one year; if the speed of light is 3×10^8 m/s, about how far is it from our galaxy to Andromeda? (1 year = 3.15 $\times 10^7$ s)

    a. 10×10^{15} m

    b. 1×10^{18} m

    c. 2×10^{22} m

    d. 6×10^{12} m

ANSWER: c

32. A cement truck can pour 120 cubic yards of cement per hour. Express this in ft^3/min.

    a. $360 \, ft^3$/min

    b. $2.00 \, ft^3$/min

    c. $18 \, ft^3$/min

    d. $6 \, ft^3$/min

    e. 54

ANSWER: e

33. Water flows into a swimming pool at the rate of 7 gal/min. The pool is 16 ft wide, 31 ft long and 8 ft deep. How long does it take to fill? (1 U.S. gallon = 231 cubic inches)

    a. 35.5 hours

    b. 71 hours

    c. 70 hours

    d. 142 hours

    e. 710 hours

ANSWER: b

34. When NASA was communicating with astronauts on the moon, the time from sending on the Earth to receiving on the moon was 1.28 s. Find the distance from Earth to the moon. (The speed of radio waves is 3.00×10^8 m/s.)

    a. 240 000 km

    b. 384 000 km

    c. 480 000 km

    d. 768 000 km

ANSWER: b

35. The mass of the sun is 2.0×10^{30} kg, and the mass of a hydrogen atom is 1.67×10^{-27} kg. If we assume that the sun is mostly composed of hydrogen, how many atoms are there in the sun?

    a. 1.2×10^{56} atoms

    b. 3.4×10^{56} atoms

    c. 1.2×10^{57} atoms

d. 2.4×10^{57} atoms

ANSWER: c

36. The information on a one-gallon paint can is that the coverage, when properly applied, is 452 ft^2. One gallon is 231 in^3. What is the average thickness of the paint in such an application?
   a. 0.0035 in
   b. 0.5111 in
   c. 0.0426 in
   d. 0.0136 in
   e. 0.1631 in

ANSWER: a

37. Assume everyone in the United States consumes one soft drink in an aluminum can every two days. If there are 280 million Americans, how many tons of aluminum need to be recycled each year if each can weighs 1/17 pound and one ton = 2000 pounds?
   a. 412000 tons
   b. 1.5 million tons
   c. 3 million tons
   d. 1 million tons
   e. 376000 tons

ANSWER: b

38. A physics class in a large lecture hall has 150 students. The total mass of the students is about _____ kg.
   a. 10^4
   b. 10^5
   c. 10^6
   d. 10^7
   e. 10^8

ANSWER: c

39. An apartment has 1100 ft^2 of floor space. What is the approximate volume of the apartment?
   a. 10^3 ft^3
   b. 10^4 ft^3
   c. 10^5 ft^3
   d. 10^6 ft^3
   e. 10^7 ft^3

ANSWER: b

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40. Which point is nearest the *x*-axis?

    a. (1, 7)

    b. (–3, –6)

    c. (–7, 5)

    d. (–6, –4)

    e. (2, 3)

ANSWER: e

41. Each edge of a cube has a length of 38.1 cm. What is the length of a diagonal of the cube going through the center of the cube?

    a. 28.0 in

    b. 26.0 in

    c. 29.5 in

    d. 24.5 in

    e. 66.0 in

ANSWER: b

42. If point A is located at coordinates (–8, 1) and point B is located at coordinates (7, –3), what is the distance from A to B if the units of the coordinated system are meters?

    a. 241 m

    b. 16 m

    c. 21 m

    d. 26 m

    e. 19 m

ANSWER: b

43. A high fountain of water is in the center of a circular pool of water. You walk the circumference of the pool and measure it to be 190 meters. You then stand at the edge of the pool and use a protractor to gauge the angle of elevation of the top of the fountain. It is 55°. How high is the fountain?

    a. 25 m

    b. 53 m

    c. 86 m

    d. 43 m

    e. 48 m

ANSWER: d

44. A right triangle has sides 10 m, 5 m, and 11 m. The smallest angle of this triangle is nearest:

    a. 32°.

    b. 27°.

    c. 22°.

    d. 63°.

    e. Not attainable since this is not a right triangle.

ANSWER: b

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45. If $\phi = 90° - \theta$, what is the value of $\sin^2 \phi + \sin^2 \theta$?
    a. 0
    b. 1
    c. −1
    d. The answer depends on θ.
ANSWER: b

46. A triangle has sides of length 7 cm and 11 cm. If the triangle is a right triangle, which of the following could be the length of the third side?
    a. 11 cm
    b. 8 cm
    c. 16 cm
    d. 17 cm
    e. 7 cm
ANSWER: b

47. A train slowly climbs a 450-m mountain track which is at an angle of 10.0° with respect to the horizontal. How much altitude does it gain?
    a. 78.1 m
    b. 225.0 m
    c. 83.1 m
    d. 443.2 m
    e. 450 m
ANSWER: a

48. Note the expression: $y = x^2$. Which statement is most consistent with this expression?
    a. If y doubles, then x quadruples.
    b. y is greater than x.
    c. If x doubles, then y doubles.
    d. If x doubles, then y quadruples.
ANSWER: d

49. Note the expression: $y = A/x^3$. Which statement is most consistent with this expression?
    a. y is less than A.
    b. If x is halved, y is multiplied by eight.
    c. If x is doubled, y is multiplied by a factor of 8.
    d. y is greater than x.
ANSWER: b

50. For which of the values below is $x > x^7$?
    a. $x = -2.0$
    b. $x = 0$
    c. $x = 1.0$

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d. $x = 2.0$

e. $x = 4.0$

ANSWER: a

51. Modern electroplaters can cover a surface area of 60.0 m^2 with one troy ounce of gold (volume = 1.611 cm^3). What is the thickness of the electroplated gold?

a. 2.69×10^{-8} m

b. 1.35×10^{-9} m

c. 1.79×10^{-6} m

d. 5.38×10^{-7} m

e. None of the above

ANSWER: a

52. The basic function of an automobile's carburetor is to atomize the gasoline and mix it with air to promote rapid combustion. Assume that 25cm^3 of gasoline is atomized into N spherical droplets. Each droplet has a radius of 1.0×10^{-5} m. Find the total surface area of these N spherical droplets.

a. 25,000 cm^2

b. 100,000 cm^2

c. 150,000 cm^2

d. 75,000 cm^2

e. 87,500 cm^2

ANSWER: d

53. A circle has an area of 4.0 m^2. A second circle has double the radius of the first. The area of the second circle is _____ times that of the first.

a. 1

b. 2.0

c. 4.0

d. 8.0

e. 4.0

ANSWER: c

54. Doubling the radius of a sphere results in increasing its volume by a factor of

a. 2

b. 4

c. 8

d. 8π

ANSWER: c

55. A room in a house has a floor area of 140 ft^2. Which of the following is most likely the approximate volume of the

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room?

   a. 4.55 m^3

   b. 45.5 m^3

   c. 455 m^3

   d. 4550 m^3

   e. 13 m^3

ANSWER: b

56. When SI units are plugged into an equation, it is found that the units balance. Which of the following can we expect to be true for this equation?

   a. The equation will be dimensionally correct.

   b. The equation will be dimensionally correct except sometimes in cases when the right hand side of the equation has more than one term.

   c. The equation will not be dimensionally correct.

   d. All constants of proportionality will be correct.

ANSWER: a

57. How long has it been that scientists have accepted that the nucleus of the atom consists of neutrons and protons? Think of your answers in terms of order of magnitude.

   a. about a decade

   b. about a century

   c. about a thousand years

   d. since Aristotle

ANSWER: b

58. Consider the sine of any angle between 30° and 40°. If the angle were doubled, what would happen to the sine of the angle?

   a. It would double.

   b. It would more than double.

   c. It would increase but be less than double.

   d. In different cases, it could do any of the above.

ANSWER: c

59. There are other ways of expressing uncertainty besides significant figures. For example, suppose a quantity is known to have a value between 20.4 and 20.0, and our best estimate of the value is midrange at 20.2. We could write the number as 20.2 +/− 0.2 and say that the number has a 1% uncertainty. We would also say it has 3 significant figures. If we square a number with 1% uncertainty (i.e., 2 parts in about 200) and 3 significant figures, what results?

   a. A number with 1% uncertainty and 3 significant figures.

   b. A number with 2% uncertainty and 3 significant figures.

   c. A number with 2% uncertainty and 2 significant figures.

   d. A number with 1% uncertainty and 2 significant figures.

ANSWER: b

60. Which is smallest, an atom, a nucleus, a proton, or an electron?

     a. atom
     b. electron
     c. nucleus
     d. proton
ANSWER: b

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1.3 Dealing with Numbers

1. Which one of the choices below represents the preferred practice regarding significant figures when adding the following: 12.4 + 14 + 67.37 + 4.201?
    a. 98   b. 98.0
    c. 97.97   d. 97.971
ANSWER: a

2. Which one of the choices below represents the preferred practice regarding significant figures when multiplying the following: 10.5 × 8.9 × 3.11?
    a. 290.6295   b. 290.63
    c. 291   d. 290
ANSWER: d

3. Calculate $(0.82 + 0.042) \times (4.49 \times 10^3)$, keeping only significant figures.
    a. 3870.8   b. 3870
    c. 3879   d. 3900
ANSWER: d

1.3 Dealing with Numbers

4. The length and width of a standard sheet of paper is measured, and then the area is found by calculation to be 93.500 in^2. The number of significant figures in the width measurement must be at least:
    a. 5   b. 4
    c. 3   d. 2
ANSWER: a

5. The number 0.0001070 has how many significant figures?
    a. 2   b. 3
    c. 4   d. 7
ANSWER: c

6. Multiplying a 4 significant figure number by a 3 significant figure number and then dividing the product by a six significant figure number yields a number with how many significant figures?
    a. 7/6   b. 3
    c. 2   d. 13
ANSWER: b

7. Modern electroplaters can cover a surface area of 55.0 m^2 with one troy ounce of gold (volume = 1.611 cm^3). What is the thickness of the electroplated gold?
    a. 3.64×10^{-7} m   b. 1.46×10^{-9} m
    c. 1.83×10^{-6} m   d. 2.93×10^{-8} m
ANSWER: d

8. The basic function of an automobile's carburetor is to atomize the gasoline and mix it with air to promote rapid

combustion. Assume that 40 cm^3 of gasoline is atomized into N spherical droplets. Each droplet has a radius of 2.0×10^{-5} m. Find the total surface area of these N spherical droplets.

   a. 60,000 cm^2 b. 24,000 cm^2

   c. 20,000 cm^2 d. 2800 cm^2

ANSWER: a

9. A circle has an area of 2.0 m^2. A second circle has triple the radius of the first. The area of the second circle is _____ times that of the first.

   a. 27   b. 9.0

   c. 3.0   d. 0.67

ANSWER: b

10. tripling the radius of a sphere results in increasing its volume by a factor of

   a. 27π   b. 27

   c. 9   d. 3

ANSWER: b

11. Two numbers, one with 4 significant figures and the other with 3 significant figures, are combined using the math operations given below. Which operation can give a result with fewer than 3 significant figures?

   a. addition   b. subtraction

   c. multiplication   d. division

ANSWER: b

1.4 Physical Quantities and Units of Measure

12. A room in a house has a floor area of 160 ft^2. Which of the following is most likely the approximate volume of the room?

   a. 4000 m^3 b. 400 m^3

   c. 40 m^3 d. 4 m^3

ANSWER: c

13. In 1983 the standard meter was redefined to what it is currently. What was the previous definition from 1960 based on?

   a. specific alloy bar housed at Sevres, France

   b. wavelength of light emitted by certain krypton atoms

   c. distance from the Earth's equator to the North Pole

   d. the distance light travels in a certain fraction of a second

ANSWER: b

1.4 Physical Quantities and Units of Measure

14. The current standard definition for the second has been based on which of the following?

   a. characteristic frequency of the light from cesium atoms

   b. average solar day

c. sidereal day

d. Greenwich Civil Time

ANSWER: a

15. On planet Q the standard unit of volume is called the guppy. Space travelers from Earth have determined that one liter = 38.2 guppies. How many guppies are in 200 liters?

    a. 70.2 guppies   b. 9.74 guppies

    c. 5.24 guppies   d. 7640 guppies

ANSWER: d

16. On planet Z, the standard unit of length is the foose. Ann the Astronaut is 5.90 feet tall on Earth. She lands on planet Z and is measured to be 94 foosi tall. Her partner Rachael is 83 foosi tall. How tall is Rachael on Earth?

    a. 5.2 feet   b. 5.5 feet

    c. 5.8 feet   d. 6.3 feet

ANSWER: a

17. A furlong is a distance of 220 yards. A fortnight is a time period of two weeks. A horse is running at a speed of 4.00 yards per second. What is his speed in furlongs per fortnight?

    a. 2200 furlongs/fortnight   b. 4980 furlongs/fortnight

    c. 11,000 furlongs/fortnight   d. 22,000 furlongs/fortnight

ANSWER: d

18. A cement truck can pour 40 cubic yards of cement per hour. Express this in ft^3/min.

    a. $2/3$ ft^3/min   b. 18 ft^3/min

    c. 6 ft^3/min   d. 2.0 ft^3/min

ANSWER: b

19. Water flows into a swimming pool at the rate of 12 gal/min. The pool is 16 ft wide, 32 ft long and 6.0 ft deep. How long does it take to fill? (1 U.S. gallon = 231 cubic inches)

    a. 32 hours   b. 64 hours

    c. 48 hours   d. 24 hours

ANSWER: a

20. The information on a one-gallon paint can is that the coverage, when properly applied, is 270 ft^2. One gallon is 231 in^3. What is the average thickness of the paint in such an application?

    a. 0.0036 in.   b. 0.0059 in.

    c. 0.043 in.   d. 0.053 in.

ANSWER: b

21. Which of the following conversion factors is not exact?

    a. 12 in. = 1 ft   b. $2.54 \times 10^{-2} m = 1\, in.$

    c. $1\, in.^2 = 6.45 \times 10^{-4} m^2$ d. $1\, kg = 1000\, g$

ANSWER: c

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1.5 Dimensions and Units

22. If v is velocity, x is position, and t is time, then which equation is not dimensionally correct?

    a. $t = x/v$ b. $t^{-2} = v^2/x^2$

    c. $v = t/x$ d. $t^2 = 2x^2/v^2$

ANSWER: c

23. The unit *slug* has what dimensions?

    a. L   b. M

    c. L/T^2 d. T/L^2

ANSWER: b

24. Volume can be measured in units of m^3. Which of the following unit combinations also result in volume?

    a. ft^2/m b. cm·ft

    c. cm^2in.   d. m^2·cm·ft

ANSWER: c

1.6 Algebra and Simultaneous Equations

25. Note the expression: $y = x^2$. Which statement is most consistent with this expression?

    a. if y doubles, then x quadruples   b. y is greater than x

    c. if x doubles, then y doubles   d. if x doubles, then y quadruples

ANSWER: d

26. Consider the cosine of any angle between 35° and 40°. If the angle were doubled, what would happen to the cosine of the angle.

    a. It would halve.

    b. It would decrease to less than half its original value.

    c. It would decrease but be more than half its original value.

    d. In different cases, it could do any of the above.

ANSWER: b

27. A high fountain of water is in the center of a circular pool of water. You walk the circumference of the pool and measure it to be 170 meters. You then stand at the edge of the pool and use a protractor to gauge the angle of elevation of the top of the fountain. It is 51°. How high is the fountain?

    a. 17 m   b. 23 m

    c. 30 m   d. 33 m

ANSWER: d

28. A right triangle has sides 5.0 m, 12 m, and 13 m. The largest angle not 90° of this triangle is nearest:

    a. 21°.

    b. 23°.

c. 67°.

d. Not attainable since this is not a right triangle.

ANSWER: c

29. A triangle has sides of lengths 14 cm and 50 cm. If the triangle is a right triangle, which of the following could be the length of the third side?

a. 26 cm b. 36 cm

c. 48 cm d. 64 cm

ANSWER: c

30. A train slowly climbs a 600-m mountain track which is at an angle of 10.0° with respect to the horizontal. How much altitude does it gain?

a. 86.8 m b. 104 m

c. 106 m d. 492 m

ANSWER: b

31. If θ and φ are each first quadrant angles, which of the following must be true if $\sin \theta = \cos \varphi$?

a. $\theta + \varphi = \pi$ rad   b. $\theta + \varphi = 90°$

c. $\theta - \varphi = \pi/2$ rad   d. $\theta = \varphi$

ANSWER: b

32. Suppose the interior angles of a triangle are φ_1, φ_2, and φ_3, with $\varphi_1 > \varphi_2 > \varphi_3$. Which side of the triangle is the shortest?

a. The side opposite φ_1.   b. The side opposite φ_2.

c. The side opposite φ_3.   d. More information is needed unless the triangle is a right triangle.

ANSWER: c

33. Which point is nearest the *y* axis?

a. (−3, 4) b. (4, 5)

c. (−5, 3) d. (5, −2)

ANSWER: a

34. Each edge of a cube has a length of 50.8 cm. What is the length of a diagonal of the cube going through the center of the cube?

a. 20.0 in b. 28.8 in

c. 34.6 in d. 50.8 in

ANSWER: c

35. If point A is located at coordinates (2, −3) and point B is located at coordinates (−3, 9), what is the distance from A to B if the units of the coordinated system are meters?

a. 17 m b. 10 m

c. 13 m d. 20 m

ANSWER: c

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36. Vectors $\vec{A}$, $\vec{B}$, and $\vec{C}$ have magnitudes 6, 11, and 22. When these vectors are added, what is the least possible magnitude of their addition?
    a. 25   b. 15
    c. 5   d. 3
ANSWER: c

37. Four vectors all have the same magnitude. Vector 1 is at 30°, Vector 2 is at 110°, vector 3 is at 240°, and Vector 4 is at 315°. Which vector has the greatest magnitude x component and which vector has the least magnitude y component?
    a. Vector 1, Vector 2   b. Vector 4, Vector 4
    c. Vector 1, Vector 1   d. Vector 3, Vector 2
ANSWER: c

38. Vector 1 is 7 units long and is at 70°. Vector 2 is 5 units long and is at 155°. Vector 3 is 3 units long and is at 225°. Which vector has equal-magnitude components?
    a. Vector 1
    b. Vector 2
    c. Vector 3
    d. None of the vectors has equal-magnitude components.
ANSWER: c

39. Of vectors with lengths 5 m, 3 m, and 4 m, which has the greatest magnitude x component?
    a. the one with length 5 m   b. the one with length 3 m
    c. the one with length 4 m   d. It could be any of the three.
ANSWER: d

40. A student adds two vectors with magnitudes of 200 and 70. Which one of the following is the only possible choice for the magnitude of their sum?
    a. 100   b. 280
    c. 200   d. 70
ANSWER: c

41. Vector $\vec{A}$ is 5 m long and vector $\vec{B}$ is 12 m long. The length of the sum of the vectors must be:
    a. some value from 7 m to 17 m.   b. 13 m.
    c. 17 m.   d. 8 m.
ANSWER: a

42. A taxicab moves five blocks due north, five blocks due east, and another three blocks due north. Assume all blocks are of equal size. How far is the taxi from its starting point?
    a. 13 blocks   b. 9.4 blocks
    c. 9.2 blocks   d. 8.6 blocks
ANSWER: b

43. Find the sum of the following two vectors: (i) 50 units due east and (ii) 100 units 30° south of west.

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    a. 100 units 30° south of west   b. 62 units 54° south of west

    c. 87 units 60° south of west   d. 62 units 15° south of west

ANSWER: b

44. Arvin the Ant travels 30 cm eastward, then 25 cm northward, and finally 10 cm westward. In what direction is Arvin now in with respect to his starting point?

    a. 59° N of E   b. 29° N of E

    c. 29° N of W   d. 51° N of E

ANSWER: d

45. Vector $\vec{A}$ is 3.0 units in length and points along the positive x axis; vector $\vec{B}$ is 5.0 units in length and points along a direction 150° from the positive x axis. What is the magnitude of the resulting vector when vectors $\vec{A}$ and $\vec{B}$ are added?

    a. 7.0   b. 6.7

    c. 2.8   d. 2.1

ANSWER: c

46. Vector $\vec{A}$ is 3.00 units in length and points along the positive x axis; vector $\vec{B}$ is 5.00 units in length and points along a direction 150° from the positive x axis. What is the direction of their sum with respect to the positive x axis?

    a. 62.0°   b. 13.0°

    c. 118°   d. 103°

ANSWER: c

47. I walk six miles in a straight line in a direction north of east, and I end up four miles north and several miles east. How many degrees north of east have I walked?

    a. 19°   b. 42°

    c. 60°   d. 71°

ANSWER: b