Exam

Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) The current definition of the standard meter of length is based on 1) _____
A) the distance traveled by light in a vacuum.
B) the distance between the earth and the sun.
C) the length of a particular object kept in France.
D) the distance between the earth's equator and north pole.
Answer: A

2) The current definition of the standard second of time is based on 2) _____
A) the earth's rotation rate.
B) the frequency of radiation emitted by cesium atoms.
C) the duration of one year.
D) the oscillation of a particular pendulum kept in France.
Answer: B

3) The current definition of the standard kilogram of mass is based on 3) _____
A) the mass of the sun.
B) the mass of the earth.
C) the mass of a cesium-133 atom.
D) the mass a particular object kept in France.
Answer: D

4) If a woman weighs 125 lb, her mass expressed in kilograms is x kg, where x is 4) _____
A) greater than 125. B) less than 125.
Answer: B

5) If a tree is 15 m tall, its height expressed in feet is x ft, where x is 5) _____
A) less than 15. B) greater than 15.
Answer: B

6) If a flower is 6.5 cm wide, its width expressed in millimeters is x mm, where x is 6) _____
A) less than 6.5. B) greater than 6.5.
Answer: B

7) If an operatic aria lasts for 5.75 min, its length expressed in seconds is x s, where x is 7) _____
A) greater than 5.75. B) less than 5.75.
Answer: A

8) Scientists use the metric system chiefly because it is more accurate than the English system. 8) _____

A) True B) False

Answer: B

9) When adding two numbers, the number of significant figures in the sum is equal to the number of significant figures in the least accurate of the numbers being added. 9) _____

A) True B) False

Answer: B

10) When determining the number of significant figures in a number, zeroes to the left of the decimal point are never counted. 10) _____

A) True B) False

Answer: B

11) Which of the following is an accurate statement? 11) _____

A) It is possible to add a scalar quantity to a vector.

B) The magnitude of a vector can be zero even though one of its components is not zero.

C) The magnitude of a vector is independent of the coordinate system used.

D) Even though two vectors have unequal magnitudes, it is possible that their vector sum is zero.

E) Rotating a vector about an axis passing through the tip of the vector does not change the vector.

Answer: C

12) If $\vec{A} - \vec{B} = 0$, then the vectors $\vec{A}$ and $\vec{B}$ have equal magnitudes and are directed in the opposite directions from each other. 12) _____

A) True B) False

Answer: B

13) Under what condition is $|\vec{A} - \vec{B}| = A + B$? 13) _____

A) Vectors $\vec{A}$ and $\vec{B}$ are in perpendicular directions.

B) The magnitude of vector $\vec{B}$ is zero.

C) Vectors $\vec{A}$ and $\vec{B}$ are in opposite directions.

D) Vectors $\vec{A}$ and $\vec{B}$ are in the same direction.

E) The statement is never true.

Answer: C

14) If $A > B$, under what condition is $|\vec{A} - \vec{B}| = A - B$? 14) _____

A) Vectors $\vec{A}$ and $\vec{B}$ re in perpendicular directions.

B) Vectors $\vec{A}$ and $\vec{B}$ are in the same direction.

C) Vectors $\vec{A}$ and $\vec{B}$ are in opposite directions.

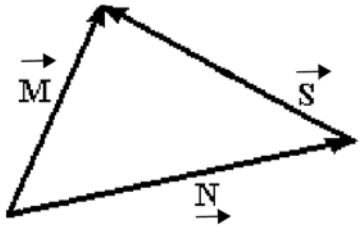
D) The statement is never true.

E) The statement is always true.

Answer: B

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

15) For the vectors shown in the figure, express vector $\vec{S}$ in terms of vectors $\vec{M}$ and $\vec{N}$. 15) _____



Answer: $\vec{S} = \vec{M} - \vec{N}$

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

16) The magnitude of a vector can never be less than the magnitude of one of its components. 16) _____

A) True B) False

Answer: A

17) If the magnitude of vector $\vec{A}$ is less than the magnitude of vector $\vec{B}$, then the x component of $\vec{A}$ is less than the x component of $\vec{B}$. 17) _____

A) True B) False

Answer: B

18) If the eastward component of vector $\vec{A}$ is equal to the westward component of vector $\vec{B}$ and their northward components are equal. Which one of the following statements about these two vectors is correct? 18) _____

A) Vector $\vec{A}$ is perpendicular to vector $\vec{B}$.

B) Vector $\vec{A}$ is parallel to vector $\vec{B}$.

C) Vectors $\vec{A}$ and $\vec{B}$ point in opposite directions.

D) The magnitude of vector $\vec{A}$ is equal to the magnitude of vector $\vec{B}$.

E) The magnitude of vector $\vec{A}$ is twice the magnitude of vector $\vec{B}$.

Answer: D

19) If all the components of a vector are equal to 1, then that vector is a unit vector. 19) _____

A) True B) False

Answer: B

20) If the dot product of two nonzero vectors is zero, the vectors must be perpendicular to each other. 20) _____

A) True B) False

Answer: A

21) If two nonzero vectors point in the same direction, their dot product must be zero. 21) _____

A) True B) False

Answer: B

22) The value of the dot product of two vectors depends on the particular coordinate system being used. 22) _____

A) True B) False

Answer: B

23) If two vectors are perpendicular to each other, their cross product must be zero. 23) _____

A) True B) False

Answer: B

24) If two vectors point in opposite directions, their cross product must be zero. 24) _____

A) True B) False

Answer: A

25) If $\vec{A}$ and $\vec{B}$ are nonzero vectors for which $\vec{A} \cdot \vec{B} = 0$, it must follow that 25) _____

A) $|\vec{A} \times \vec{B}| = 1$. B) $\vec{A}$ is parallel to $\vec{B}$.

C) $|\vec{A} \times \vec{B}| = AB$. D) $\vec{A} \times \vec{B} = 0$.

Answer: C

26) Convert 1.2×10^{-3} to decimal notation. 26) _____

A) 1.200 B) 0.1200 C) 0.0120 D) 0.0012 E) 0.00012

Answer: D

27) Write out the number 7.35×10^{-5} in full with a decimal point and correct number of zeros. 27) _____

A) 0.00000735
B) 0.0000735
C) 0.000735
D) 0.00735
E) 0.0735

Answer: B

28) 0.0001776 can also be expressed as 28) _____

A) 1.776×10^{-3}.
B) 1.776×10^{-4}.
C) 17.72×10^{4}.
D) 1772×10^{5}.
E) 177.2×10^{7}.

Answer: B

29) 0.00325×10^{-8} cm can also be expressed in mm as 29) _____

A) 3.25×10^{-12} mm.
B) 3.25×10^{-11} mm.
C) 3.25×10^{-10} mm.
D) 3.25×10^{-9} mm.
E) 3.25×10^{-8} mm.

Answer: C

30) If, in a parallel universe, π has the value 3.14149, express π in that universe to four significant figures. 30) _____

A) 3.141 B) 3.142 C) 3.1415 D) 3.1414

Answer: A

31) The number 0.003010 has 31) _____

A) 7 significant figures. B) 6 significant figures.
C) 4 significant figures. D) 2 significant figures.

Answer: C

32) What is $\frac{0.674}{0.74}$ to the proper number of significant figures? 32) _____

A) 0.9 B) 0.91 C) 0.9108 D) 0.911

Answer: B

33) What is the value of $\pi(8.104)^2$, written with the correct number of significant figures? 33) _____

A) 206.324 B) 206.323 C) 206.3 D) 206 E) 200

Answer: C

34) What is the sum of 1123 and 10.3 written with the correct number of significant figures? 34) _____

A) 1.13×10^3

B) 1133.3000

C) 1.1×10^3

D) 1133

E) 1133.3

Answer: D

35) What is the sum of 1.53 + 2.786 + 3.3 written with the correct number of significant figures? 35) _____

A) 8 B) 7.6 C) 7.62 D) 7.616 E) 7.6160

Answer: B

36) What is the difference between 103.5 and 102.24 written with the correct number of significant figures? 36) _____

A) 1 B) 1.3 C) 1.26 D) 1.260 E) 1.2600

Answer: B

37) What is the product of 11.24 and 1.95 written with the correct number of significant figures? 37) _____

A) 22 B) 21.9 C) 21.92 D) 21.918 E) 21.9180

Answer: B

38) What is the result of 1.58 ÷ 3.793 written with the correct number of significant figures? 38) _____

A) 4.2×10^{-1}

B) 4.1656×10^{-1}

C) 4.166×10^{-1}

D) 4.17×10^{-1}

E) 4×10^{-1}

Answer: D

39) What is $34 + (3) \times (1.2465)$ written with the correct number of significant figures? 39) _____

A) 38 B) 37.74 C) 37.7 D) 4×10^1 E) 37.7395

Answer: A

40) What is $56 + (32.00)/(1.2465 + 3.45)$ written with the correct number of significant figures? 40) _____

A) 62.8123846
B) 62.8
C) 63
D) 62.812
E) 62.81

Answer: C

41) Add 3685 g and 66.8 kg and express your answer in milligrams (mg). 41) _____

A) 7.05×10^6 mg B) 7.05×10^7 mg
C) 7.05×10^5 mg D) 7.05×10^4 mg

Answer: B

42) Express $(4.3 \times 10^6)^{-1/2}$ in scientific notation. 42) _____

A) 2.1×10^4 B) 2.1×10^3 C) 4.8×10^{-4} D) 2.1×10^{-5}

Answer: C

43) What is $0.205^{2/3}$, expressed to the proper number of significant figures? 43) _____

A) 0.3477 B) 0.348 C) 0.35 D) 0.3

Answer: B

44) The length and width of a rectangle are 1.125 m and 0.606 m, respectively. Multiplying, your calculator gives the product as 0.68175. Rounding properly to the correct number of significant figures, the area should be written as 44) _____

A) 0.7 m^2.
B) 0.68 m^2.
C) 0.682 m^2.
D) 0.6818 m^2.
E) 0.68175 m^2.

Answer: C

45) The following exact conversion equivalents are given: 1 m = 100 cm, 1 in = 2.54 cm, and 1 ft = 12 in. If a computer screen has an area of 1.27 ft^2, this area is closest to 45) _____

A) 4.65 m^2.

B) 0.0465 m^2.

C) 0.284 m^2.

D) 0.118 m^2.

E) 0.00284 m^2.

Answer: D

46) In addition to 1 m = 39.37 in., the following exact conversion equivalents are given: 1 mile = 5280 ft, 1 hour = 60 min, and 1 min = 60 s. If a particle has a velocity of 8.4 miles per hour, its velocity, in m/s, is closest to 46) _____

A) 4.1 m/s. B) 3.8 m/s. C) 3.0 m/s. D) 3.4 m/s. E) 4.5 m/s.

Answer: B

47) A weight lifter can bench press 171 kg. How many milligrams (mg) is this? 47) _____

A) 1.71×10^8 mg B) 1.71×10^9 mg

C) 1.71×10^7 mg D) 1.71×10^6 mg

Answer: A

48) How many nanoseconds does it take for a computer to perform one calculation if it performs 6.7×10^7 calculations per second? 48) _____

A) 65 ns B) 15 ns C) 11 ns D) 67 ns

Answer: B

49) The shortest wavelength of visible light is approximately 400 nm. Express this wavelength in centimeters. 49) _____

A) 4×10^{-11} cm

B) 4×10^{-5} cm

C) 400×10^{-11} cm

D) 4×10^{-9} cm

E) 4×10^{-7} cm

Answer: B

50) The wavelength of a certain laser is 0.35 micrometers, where 1 micrometer = 1×10^{-6} m. Express this wavelength in nanometers. 50) _____

A) 3.5×10^4 nm B) 3.5×10^1 nm C) 3.5×10^3 nm D) 3.5×10^2 nm

Answer: D

51) A certain CD-ROM disk can store approximately 6.0×10^2 megabytes of information, where 10^6 bytes = 1 megabyte. If an average word requires 9.0 bytes of storage, how many words can be stored on one disk? 51) _____

A) 6.7×10^7 words
B) 5.4×10^9 words
C) 2.0×10^9 words
D) 2.1×10^7 words

Answer: A

52) A plot of land contains 5.8 acres. How many square meters does it contain? [1 acre = 43,560 ft^2] 52) _____

A) 7.1×10^3 m^2
B) 5.0×10^4 m^2
C) 2.3×10^4 m^2
D) 7.0×10^4 m^2

Answer: C

53) A person on a diet loses 1.6 kg in a week. How many micrograms/second (μg/s) are lost? 53) _____

A) 2.6×10^3 μg/s
B) 6.4×10^4 μg/s
C) 44 μg/s
D) 1.6×10^5 μg/s

Answer: A

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

54) Albert uses as his unit of length (for walking to visit his neighbors or plowing his fields) the albert (A), the distance Albert can throw a small rock. One albert is 92 meters. How many square alberts is equal to one acre? (1 acre = 43,560 ft^2 = 4050 m^2) 54) _____

Answer: 1.29 A^2

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

55) Convert a speed of 4.50 km/h to units of ft/min. (1.00 m = 3.28 ft) 55) _____

A) 0.246 ft/min
B) 886 ft/min
C) 165 ft/min
D) 246 ft/min
E) 82.3 ft/min

Answer: D

56) The exhaust fan on a typical kitchen stove pulls 600 CFM (cubic feet per minute) through the filter. Given that 1.00 in. = 2.54 cm, how many cubic meters per second does this fan pull? 56) _____

A) 0.283 m^3/sec
B) 32.8 m^3/sec
C) 0.328 m^3/sec
D) 3.05 m^3/sec

Answer: A

57) The mass of a typical adult woman is closest to 57) _____

A) 35 kg. B) 150 kg. C) 75 kg. D) 20 kg.

Answer: C

58) The height of the ceiling in a typical home, apartment, or dorm room is closest to 58) _____

A) 100 cm. B) 200 cm. C) 400 cm. D) 500 cm.

Answer: B

59) Approximately how many times does an average human heart beat in a year? 59) _____

A) 4×10^7 B) 4×10^6 C) 4×10^8 D) 4×10^5 E) 4×10^9

Answer: A

60) Approximately how many times does an average human heart beat in a lifetime? 60) _____

A) 3×10^8 B) 3×10^{10} C) 3×10^7 D) 3×10^9 E) 3×10^{11}

Answer: D

61) Approximately how many pennies would you have to stack to reach an average 8-foot ceiling? 61) _____

A) 2×10^2 B) 2×10^4 C) 2×10^3 D) 2×10^6 E) 2×10^5

Answer: C

62) Estimate the number of times the earth will rotate on its axis during a human's lifetime. 62) _____

A) 3×10^6 B) 3×10^5 C) 3×10^8 D) 3×10^7 E) 3×10^4

Answer: E

63) Estimate the number of pennies that would fit in a box one foot long by one foot wide by one foot tall. 63) _____

A) 5×10^5 B) 5×10^2 C) 5×10^4 D) 5×10^6 E) 5×10^3

Answer: C

64) A marathon is 26 mi and 385 yd long. Estimate how many strides would be required to run a marathon. Assume a reasonable value for the average number of feet/stride. 64) _____

A) 4.5×10^5 strides B) 4.5×10^3 strides

C) 4.5×10^4 strides D) 4.5×10^6 strides

Answer: C

65) The period of a pendulum is the time it takes the pendulum to swing back and forth once. If the only dimensional quantities that the period depends on are the acceleration of gravity, g, and the length of the pendulum, ℓ, what combination of g and ℓ must the period be proportional to? (Acceleration has SI units of $m \cdot s^{-2}$.) 65) _____

A) $g\ell$ B) $g\ell^2$ C) g/ℓ D) $\sqrt{g\ell}$ E) $\sqrt{\ell/g}$

Answer: E

66) The speed of a wave pulse on a string depends on the tension, F, in the string and the mass per unit length, μ, of the string. Tension has SI units of kg • m • s^{-2} and the mass per unit length has SI units of kg • m^{-1}. What combination of F and μ must the speed of the wave be proportional to? 66) _____

A) μ / F B) $\sqrt{F/\mu}$ C) $\sqrt{\mu F}$ D) F / μ E) $\sqrt{\mu/F}$

Answer: D

67) The position x, in meters, of an object is given by the equation $x = A + Bt + Ct^2$, where t represents time in seconds. What are the SI units of A, B, and C? 67) _____

A) m/s, m/s^2, m/s^3
B) m, m, m
C) m, s, s
D) m, m/s, m/s^2
E) m, s, s^2

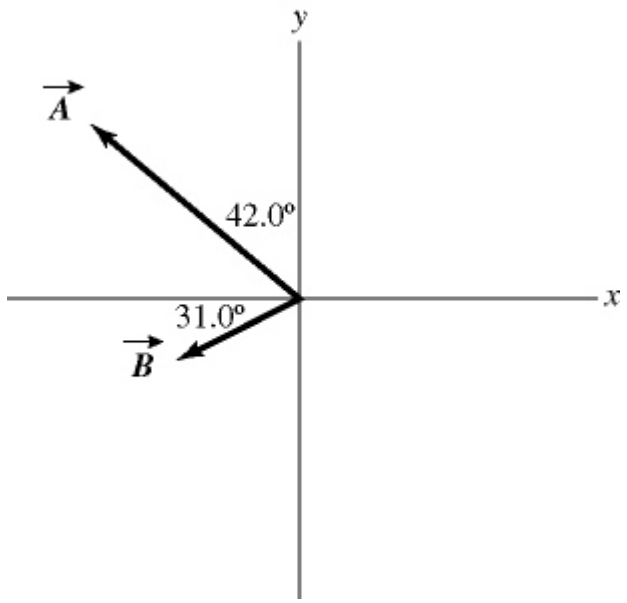
Answer: B

68) You walk 55 m to the north, then turn 60° to your right and walk another 45 m. How far are you from where you originally started? 68) _____

A) 94 m B) 50 m C) 46 m D) 87 m

Answer: D

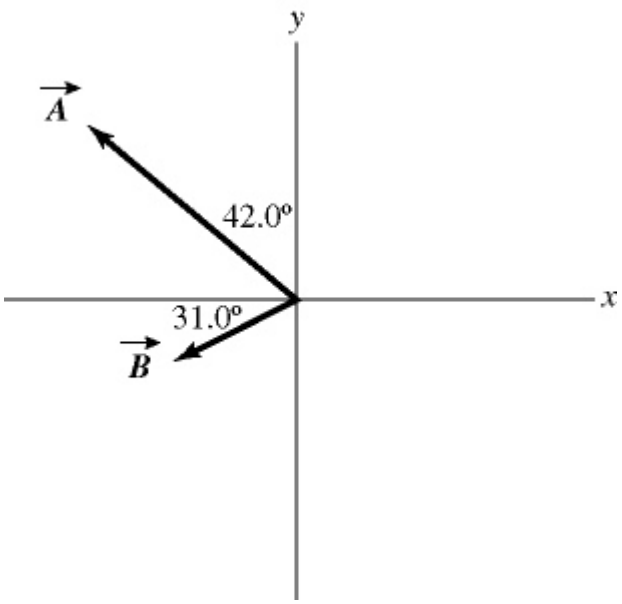
69) Vectors $\vec{A}$ and $\vec{B}$ are shown in the figure. Vector $\vec{C}$ is given by $\vec{C} = \vec{B} - \vec{A}$. The magnitude of vector $\vec{A}$ is 16.0 units, and the magnitude of vector $\vec{B}$ is 7.00 units. What is the magnitude of vector $\vec{C}$? 69) _____



A) 9.53 B) 9.00 C) 16.2 D) 17.5 E) 15.5

Answer: C

70) Vectors $\vec{A}$ and $\vec{B}$ are shown in the figure. Vector $\vec{C}$ is given by $\vec{C} = \vec{B} - \vec{A}$. The magnitude of vector $\vec{A}$ is 16.0 units, and the magnitude of vector $\vec{B}$ is 7.00 units. What is the angle of vector $\vec{C}$, measured counterclockwise from the +*x*-axis? 70) _____



A) 22.4° B) 292° C) 73.1° D) 287° E) 16.9°

Answer: D

71) A rabbit trying to escape a fox runs north for 8.0 m, darts northwest for 1.0 m, then drops 1.0 m down a hole into its burrow. What is the magnitude of the net displacement of the rabbit? 71) _____

A) 8.1 m B) 66 m C) 8.8 m D) 10 m

Answer: C

72) You walk 53 m to the north, then turn 60° to your right and walk another 45 m. Determine the direction of your displacement vector. Express your answer as an angle relative to east. 72) _____

A) 50° N of E B) 69° N of E C) 57° N of E D) 63° N of E

Answer: D

73) Vector $\vec{A}$ has a magnitude 5.00 and points in a direction 40.0° clockwise from the negative *y* axis. What are the *x* and *y* components of vector $\vec{A}$. 73) _____

A) A_X = -3.21 and A_Y = -3.83

B) A_X = 3.83 and A_Y = 3.21

C) A_X = -3.21 and A_Y = 3.83

D) A_X = 3.83 and A_Y = -3.21

E) A_X = 4.29 and A_Y = 2.16

Answer: A

74) The components of vector $\vec{A}$ are A_x = + 3.90 and A_y = -4.00. What is the angle measured counterclockwise from the +x-axis to vector $\vec{A}$? 74) _____

A) 136° B) 46.0° C) 314° D) 224° E) 134°

Answer: C

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

75) Vector $\vec{\mathbf{A}}$ has a magnitude of 5.5 cm and points along the *x*-axis. Vector $\vec{\mathbf{B}}$ has a magnitude of 7.5 cm and points at +30° above the negative *x*-axis. 75) _____

(a) Determine the *x* and *y* components of Vector $\vec{\mathbf{A}}$.

(b) Determine the *x* and *y* components of Vector $\vec{\mathbf{B}}$.

(c) Determine *x* and *y* components of the sum of these two vectors.

(d) Determine the magnitude and direction of the sum of these two vectors.

Answer: (a) A_x = 5.5 cm, A_y = 0

(b) B_x = -6.5 cm, B_y = 3.8 cm

(c) R_x = -1.0 cm, R_y = 3.8 cm

(d) 3.9 cm at 75° above -*x*-axis

76) Vector $\vec{\mathbf{A}}$ has a magnitude of 75.0 cm and points at 30° above the positive *x*-axis. Vector $\vec{\mathbf{B}}$ has a magnitude of 25.0 cm and points along the negative *x*-axis. Vector $\vec{\mathbf{C}}$ has a magnitude of 40.0 cm and points at 45° below the negative *x*-axis. 76) _____

(a) Determine the *x* and *y* components of Vector $\vec{\mathbf{A}}$.

(b) Determine the *x* and *y* components of Vector $\vec{\mathbf{B}}$.

(c) Determine the *x* and *y* components of Vector $\vec{\mathbf{C}}$.

(d) Determine *x* and *y* components of the sum of these three vectors.

(e) Determine the magnitude and direction of the sum of these three vectors.

Answer: (a) A_x = 65 cm, A_y = 38 cm

(b) B_x = -25 cm, B_y = 0

(c) C_x = -28 cm, C_y = -28 cm

(d) R_x = 12 cm, R_y = 9.2 cm

(e) 15 cm at 38° above +*x*-axis

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

77) A helicopter is flying horizontally with a speed of 444 m/s over a hill that slopes upward with a 2% grade (that is, the "rise" is 2% of the "run"). What is the component of the helicopter's velocity perpendicular to the sloping surface of the hill? 77) _____

A) 444 m/s B) 220 m/s C) 8.9 m/s D) 435 m/s

Answer: C

78) An apple falls from an apple tree growing on a 20° slope. The apple hits the ground with an impact velocity of 16.2 m/s straight downward. What is the component of the apple's impact velocity parallel to the surface of the slope? 78) _____

A) 12 m/s B) 8.7 m/s C) 5.5 m/s D) 15 m/s

Answer: C

79) The components of vector $\vec{A}$ are A_x = +2.2 and A_y = -6.9, and the components of vector $\vec{B}$ are given are B_x = -6.1 and B_y = -2.2. What is the magnitude of the vector $\vec{B}$ - $\vec{A}$? 79) _____

A) 9.5 B) 6.1 C) 91 D) 9.9 E) 0.76

Answer: A

80) The components of vector $\vec{B}$ are B_x = -3.5 and B_y = -9.7, and the components of vector $\vec{C}$ are C_x = -6 and C_y = +8.1. What is the angle (less than 180 degrees) between vectors $\vec{B}$ and $\vec{C}$? 80) _____

A) 17° B) 163° C) 56° D) 124° E) 106°

Answer: D

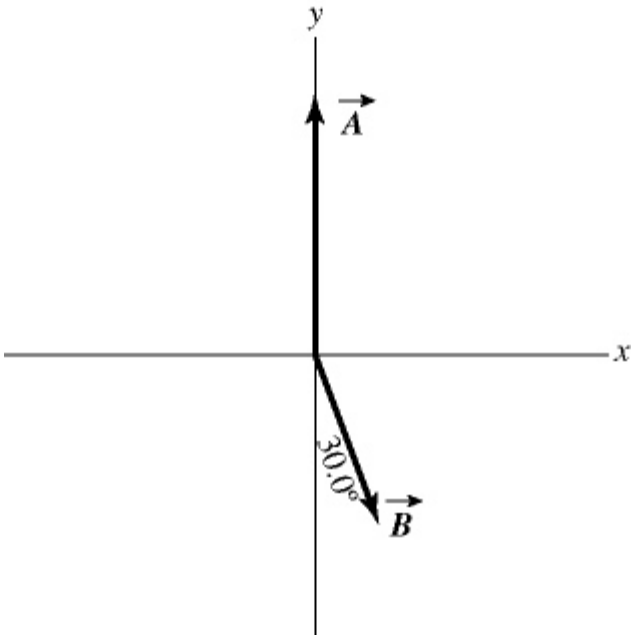
81) An airplane undergoes the following displacements: First, it flies 66 km in a direction 30° east of north. Next, it flies 49 km due south. Finally, it flies 100 km 30° north of west. Using vector components, determine how far the airplane ends up from its starting point. 81) _____

A) 76 km B) 78 km C) 82 km D) 79 km E) 81 km

Answer: D

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

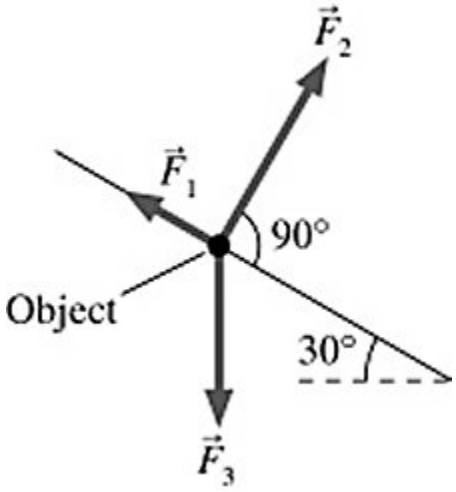
82) In the figure, the magnitude of vector $\vec{A}$ is 18.0 units, and the magnitude of vector $\vec{B}$ is 12.0 units. What vector $\vec{C}$ must be added to the vectors $\vec{A}$ and $\vec{B}$ so that the resultant of these three vectors points in the -x direction and has a magnitude of 7.50 units? Use vector components to find your answer, and express vector $\vec{C}$ by giving its magnitude and the angle it makes with the +x-axis taking counterclockwise to be positive. 82) _____



Answer: 15.5, 209°

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

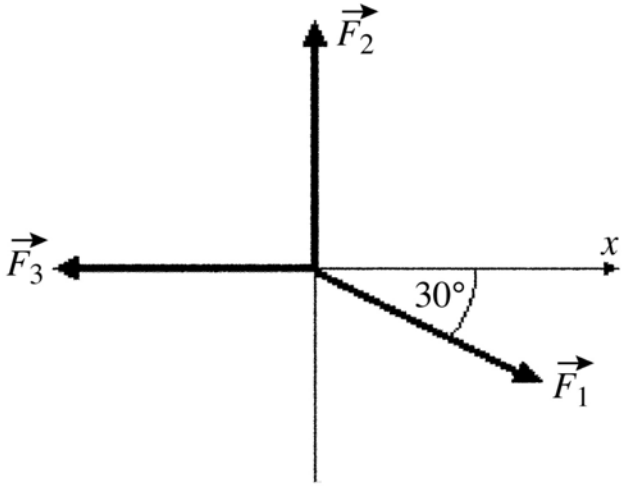
83) Three forces are exerted on an object placed on a tilted floor. Forces are vectors. The three forces are directed as shown in the figure. If the forces have magnitudes F_1 = 1.0 N, F_2 = 8.0 N and F_3 = 7.0 N, where N is the standard unit of force, what is the component of the *net force* $\vec{F}_{\text{net}} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3$ parallel to the floor? 83) _____



A) 6.0 N B) 7.8 N C) 5.1 N D) 2.5 N

Answer: D

84) As shown in the figure, three force vectors act on an object. The magnitudes of the forces as shown in the figure are F_1 = 80.0 N, F_2 = 60.0 N, and F_3 = 40.0 N, where N is the standard SI unit of force. The resultant force acting on the object is given by 84) _____



A) 180 N at an angle 60.0° with respect to +*x*-axis.
B) 35.5 N at an angle 34.3° with respect to +*x*-axis.
C) 60.0 N at an angle 90.0° with respect to +*x*-axis.
D) 20.0 N at an angle 34.3° with respect to +*x*-axis.
E) 40.0 N at an angle 60.0° with respect to +*x*-axis.

Answer: B

85) A teacher sends her students on a treasure hunt. She gives the following instructions: 85) _____

1. Walk 300 m north.
2. Walk 400 m northwest.
3. Walk 700 m east-southeast and the treasure is buried there.

As all the other students walk off following the instructions, Jane physics student quickly adds the displacements and walks in a straight line to find the treasure. How far and in what direction does Jane need to walk?

A) 399 m in a direction 52.5° north of east
B) 284 m in a direction 28.2° west of north
C) 481 m in a direction 40.9° north of east
D) 187 m in a direction 67.3° north of east
E) The treasure position cannot be reached in one straight walk.

Answer: C

86) Vector $\vec{A} = -3.00\,\hat{i} + 3.00\,\hat{j}$ and vector $\vec{B} = 3.00\,\hat{i} + 4.00\,\hat{j}$. What is vector $\vec{C} = \vec{A} + \vec{B}$? 86) _____

A) $7.00\,\hat{i} + 7.00\,\hat{j}$
B) $-3.00\,\hat{i} + 7.00\,\hat{j}$
C) $-3.00\,\hat{i} - 3.00\,\hat{j}$
D) $0.00\,\hat{i} + 7.00\,\hat{j}$
E) $0.00\,\hat{i} + 3.00\,\hat{j}$

Answer: D

87) Vector $\vec{A} = 1.00\,\hat{i} + -2.00\,\hat{j}$ and vector $\vec{B} = 3.00\,\hat{i} + 4.00\,\hat{j}$. What are the magnitude and direction of vector $\vec{C} = \vec{A} + \vec{B}$? 87) _____

A) 7.21 in a direction 56.3° counterclockwise from the positive *x* axis
B) 7.21 in a direction 33.7° counterclockwise from the positive *x* axis
C) 4.47 in a direction 6.34° counterclockwise from the positive *x* axis
D) 4.47 in a direction 26.6° counterclockwise from the positive *x* axis
E) 6.00 in a direction 63.4° counterclockwise from the positive *x* axis

Answer: D

88) What is the magnitude of $\vec{A} + \vec{B} + \vec{C}$, where $\vec{A} = 1.00\,\hat{i} + 4.00\,\hat{j} - 1.00\,\hat{k}$, 88) _____
$\vec{B} = 3.00\,\hat{i} - 1.00\,\hat{j} - 4.00\,\hat{k}$ and $\vec{C} = -1.00\,\hat{i} + 1.00\,\hat{j}$?

A) 8.12 B) 10.76 C) 6.78 D) 2.00 E) 7.07

Answer: E

89) If $\vec{A} = +4\,\hat{i} - 2\,\hat{j} - 3\,\hat{k}$ and $\vec{C} = -4\,\hat{i} - 2\,\hat{j} - 3\,\hat{k}$, which of the following numbers is closest to the magnitude of $\vec{A} - \vec{C}$? 89) _____

A) 8 B) 10 C) 7 D) 11 E) 9

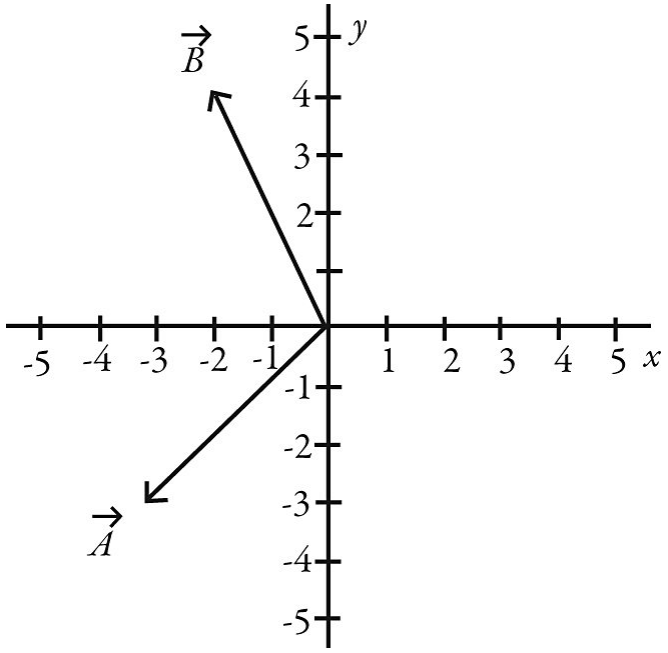
Answer: A

90) Vector $\vec{A} = -1.00\hat{i} + -2.00\hat{j}$ and vector $\vec{B} = 3.00\,\hat{i} + 4.00\,\hat{j}$. What are the magnitude and direction of vector $\vec{C} = 3.00\vec{A} + 2.00\vec{B}$? 90) _____

A) 6.72 in a direction 34.4° counterclockwise from the positive *x*-axis
B) 3.61 in a direction -56.3° counterclockwise from the positive *x*-axis
C) 3.61 in a direction 56.3° counterclockwise from the positive *x*-axis
D) 3.61 in a direction 33.7° counterclockwise from the positive *x*-axis
E) 5.00 in a direction 56.3° counterclockwise from the positive *x* axis

Answer: D

91) Vectors $\vec{A}$ and $\vec{B}$ are shown in the figure. What is $\left|-5.00\vec{A} + 4.00\vec{B}\right|$? 91) _____



A) 34.0
B) 1028
C) $-32.0\hat{i} - 2.00\hat{j}$
D) $-2.00\hat{i} - 32.0\hat{j}$
E) 31.8

Answer: E

92) Determine the scalar product of $\vec{A} = 6.0\,\hat{i} + 4.0\hat{j} - 2.0\hat{k}$ and $\vec{B} = 5.0\hat{i} - 6.0\hat{j} - 3.0\hat{k}$. 92) _____

A) 12
B) $30\,\hat{i} - 24\hat{j} + 6\hat{k}$
C) 60
D) $30\,\hat{i} + 24\hat{j} + 6\hat{k}$
E) undefined

Answer: A

93) Determine the angle between the directions of vector $\vec{A} = 3.00\hat{i} + 1.00\hat{j}$ and vector $\vec{B} = -3.00\hat{i} + 3.00\hat{j}$. 93) _____

A) 45.2° B) 30.0° C) 117° D) 26.6° E) 88.1°

Answer: C

94) The scalar product of vector $\vec{A} = 3.00\hat{i} + 2.00\hat{j}$ and vector $\vec{B}$ is 10.0. Which of the following vectors could be vector $\vec{B}$? 94) _____

A) $4.00\hat{i} + 6.00\hat{j}$

B) $5.00\hat{i} + 4.00\hat{j}$

C) $12.0\hat{i}$

D) $2.00\hat{i} + 4.00\hat{j}$

E) $2.00\hat{i} + 2.00\hat{j}$

Answer: E

95) The angle between vector $\vec{A} = 2.00\hat{i} + 3.00\hat{j}$ and vector $\vec{B}$ is 45.0°. The scalar product of vectors $\vec{A}$ and $\vec{B}$ is 3.00. If the *x* component of vector $\vec{B}$ is positive, what is vector $\vec{B}$. 95) _____

A) $4.76\hat{i} + 0.952\hat{j}$

B) $2.96\hat{i} + -0.973\hat{j}$

C) $1.15\hat{i} + 0.231\hat{j}$

D) $3.42\hat{i} + 0.684\hat{j}$

E) $0.871\hat{i} + 0.419\hat{j}$

Answer: C

96) What is the angle between the vector $\vec{A} = +3\hat{i} - 2\hat{j} - 3\hat{k}$ and the +*y*-axis? 96) _____

A) 90° B) 115° C) 25° D) 155° E) 65°

Answer: B

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

97) If $\vec{A} = 3\hat{i} - \hat{j} + 4\hat{k}$ and $\vec{B} = x\hat{i} + \hat{j} - 5\hat{k}$, find *x* so $\vec{B}$ will be perpendicular to $\vec{A}$. 97) _____

Answer: 7

98) Two boys searching for buried treasure are standing underneath the same tree. One boy walks 18 m east and then 18 m north. The other boy walks 16 m west and then 11 m north. Find the scalar product of their net displacements from the tree. 98) _____

Answer: $-90\ m^2$

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

99) A rectangular box is positioned with its vertices at the following points: 99) _____

A = (0,0,0) C = (2,4,0) E = (0,0,3) G = (2,4,3)

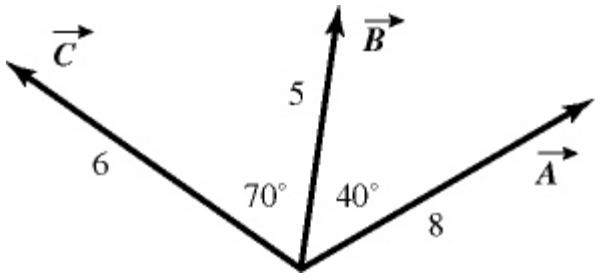
B = (2,0,0) D = (0,4,0) F = (2,0,3) H = (0,4,3)

If the coordinates all have three significant figures, the angle between the line segments AG and AH is closest to:

A) 21.8°. B) 22.5°. C) 26.6°. D) 45.0°. E) 36.9°.

Answer: A

100) For the vectors shown in the figure, assume numbers are accurate to two significant figures. The scalar product $\vec{A} \times \vec{C}$ is closest to 100) _____



A) zero. B) 16. C) -45. D) 45. E) -16.

Answer: E

101) What is the vector product of $\vec{A} = 2.00\,\hat{i} + 3.00\,\hat{j} + 1.00\,\hat{k}$ and $\vec{B} = 1.00\,\hat{i} - 3.00\,\hat{j} - 2.00\,\hat{k}$? 101) _____

A) $2.00\,\hat{i} - 9.00\,\hat{j} - 2.00\,\hat{k}$

B) $-9.00\,\hat{i} - 3.00\,\hat{j} - 3.00\,\hat{k}$

C) $-3.00\,\hat{i} + 5.00\,\hat{j} - 9.00\,\hat{k}$

D) $-4.00\,\hat{i} + 3.00\,\hat{j} - 1.00\,\hat{k}$

E) $-5.00\,\hat{i} + 2.00\,\hat{j} - 6.00\,\hat{k}$

Answer: C

102) What is the magnitude of the cross product of a vector of magnitude 2.00 m pointing east and a vector of magnitude 4.00 m pointing 30.0° west of north? 102) _____

A) 8.00 B) 4.00 C) 6.93 D) -6.93 E) -4.00

Answer: C

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

103) If the magnitude of the cross product of two vectors is one-half the dot product of the same vectors, what is the angle between the two vectors? 103) _____

Answer: 26.6°

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

104) If $\vec{C} = -4\hat{i} - 2\hat{j} - 3\hat{k}$, what is $\vec{C} \times \hat{j}$? 104) _____

A) $-3\hat{i} - 2\hat{j} + 4\hat{k}$
B) $-3\hat{i} + 4\hat{k}$
C) $+3\hat{i} - 4\hat{k}$
D) $+3\hat{i} + 4\hat{k}$
E) $+3\hat{i} + 2\hat{j} - 4\hat{k}$

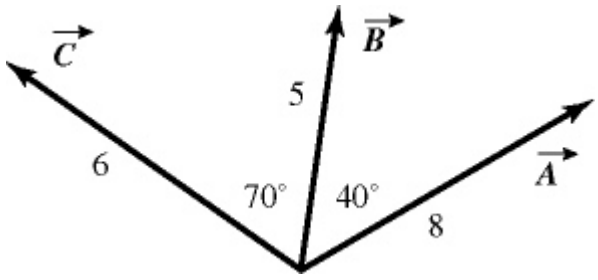
Answer: C

105) If $\vec{B} = -2\hat{i} - 6\hat{j} + 2\hat{k}$ and $\vec{C} = -2\hat{i} - 2\hat{j} - 3\hat{k}$, which of the following numbers is closest to the magnitude of $\vec{C} \times \vec{B}$? 105) _____

A) 13 B) 17 C) 9 D) 25 E) 21

Answer: D

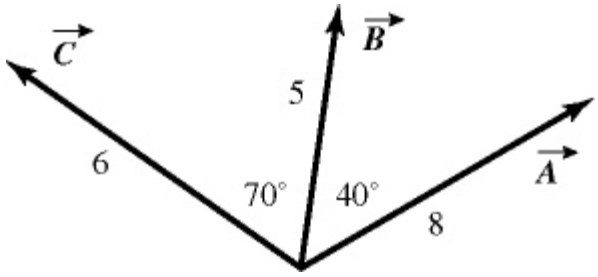
106) For the vectors shown in the figure, find the magnitude and direction of $\vec{B} \times \vec{A}$, assuming that the quantities shown are accurate to two significant figures. 106) _____



A) 31, directed on the plane
B) 26, directed into the plane
C) 26, directed out of the plane
D) 31, directed out of the plane
E) 31, directed into the plane

Answer: B

107) For the vectors shown in the figure, find the magnitude and direction of the vector product $\vec{A} \times \vec{C}$, assuming that the quantities shown are accurate to two significant figure. 107) _____



A) 16, directed out of the plane
B) 45, directed on the plane
C) 16, directed into the plane
D) 45, directed out of the plane
E) 45, directed into the plane

Answer: D