Q1.

The speed of an object is given by: $v = \sqrt{\frac{B}{\rho}}$ , where ρ is the density of the object, and *B* is a constant.

What are the dimensions of *B*?

A) $ML^{-1} T^{-2}$
B) $ML^{-2} T^{-1}$
C) $M^{-1}L^{-1} T^{-2}$
D) $M^{-1}L^{-2} T^{-1}$
E) $TM^2$

---

Q2.

A car is driving at 70 miles/hour. Express this speed in (m/s). (1 mile = 5280 ft, and 1m = 3.3 ft)

A) 31
B) 47
C) 14
D) 28
E) 56

---

Q3.

The position of an object moving along a straight line is given by the equation: $x = 4.0t + t^2$, where *x* is in meters and *t* is in seconds. What is the average velocity of the object in the time interval from *t* = 2.0 s to *t* = 5.0 s?

A) 11 m/s
B) 44 m/s
C) 17 m/s
D) 94 m/s
E) 23 m/s

---

Q4.

Points A and B are separated by 1200 m. A particle starts from rest at point A and accelerates at + 1.20 $m/s^2$ through the first half of the distance, and decelerates at – 1.20 $m/s^2$ through the second half until it stops at B. What is the total travel time?

A) 63.2 s
B) 13.6 s
C) 510 s
D) 99.4 s
E) 17.9 s

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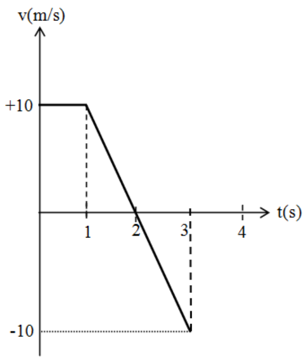
Q5.

A particle moves along the *x* axis with the velocity *v(t)* that is shown in **Figure 1**. Find the acceleration of the particle at $t$ = 2.0 s.




A) – 10 m/s$^2$
B) + 10 m/s$^2$
C) – 20 m/s$^2$
D) + 20 m/s$^2$
E) zero

---

Q6.

Two objects (A and B) are thrown vertically upward from the ground with velocities $v_A$ = 100 m/s and $v_B$ = 10 m/s. The maximum heights reached by A and B are $h_A$ and $h_B$, respectively. The ratio $h_A$ / $h_B$ is:

A) 100
B) 10
C) 1000
D) 1/10
E) 1/100

---

Q7.

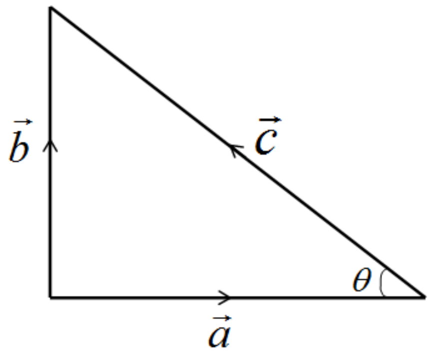
A car travels at 40 km/h for 2.0 h, then at 50 km/h for 1.0 h, and finally at 20 km/h for 0.50 h. What is the average speed of the car for the whole trip?

A) 40 km/h
B) 37 km/h
C) 55 km/h
D) 45 km/h
E) 32 km/h

---

Q8.

Vectors $\vec{a}$ , $\vec{b}$ and $\vec{c}$ are shown in **Figure 2**. Vector $\vec{c}$ is equal to




A) $\vec{b}-\vec{a}$

B) $\vec{b}+\vec{a}$

C) $\vec{a}-\vec{b}$

D) $\vec{a}\,cos\theta$

E) $\vec{b}cos\theta$

---

Q9.

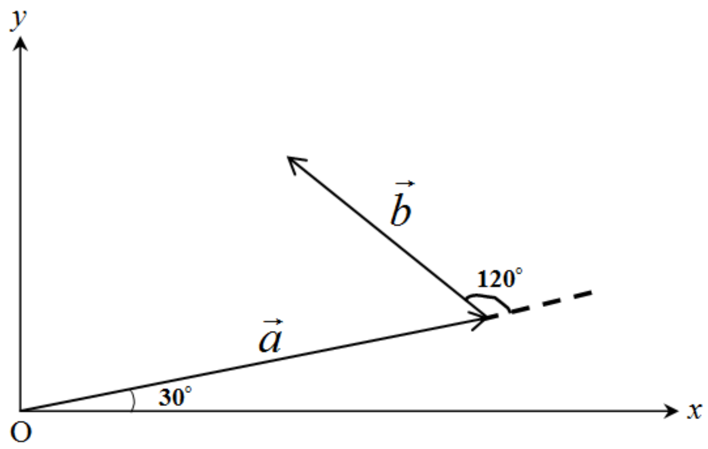
Two vectors are given by: $\vec{A} = -3.0\hat{i}+4.0\hat{j}$ and $\vec{B}=4.0\hat{j}+3.0\hat{k}$ . What is the angle between $\vec{A}$ and $\vec{B}$ ?

A) 50°
B) 68°
C) 39°
D) 90°
E) zero

---

Q10.

Two vectors $\vec{a}$ and $\vec{b}$ have equal magnitudes of 10 units, and are oriented as shown in **Figure 3**. Their vector sum is $\vec{r}$. What are the magnitude of $\vec{r}$ and the angle $\vartheta$ it makes with the + *x* axis?




A) $r$ = 10 units, $\theta$ = 90°
B) $r$ = 20 units, $\theta$ = 150°
C) $r$ = 33 units, $\theta$ = 60°
D) $r$ = 20 units, $\theta$ = 30°
E) $r$ = 13 units, $\theta$ = 80°

---

Q11.

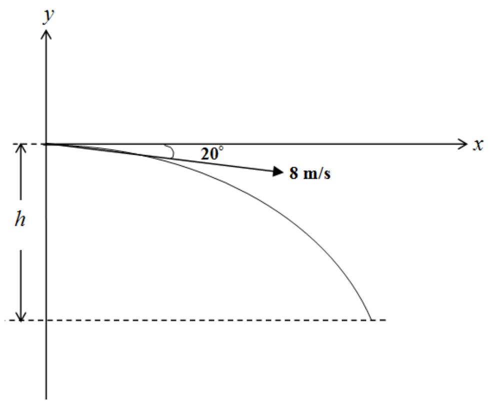
At time *t* = 0, a particle leaves the origin with a velocity of 6.0 m/s in the positive *y*-direction and moves in the *xy* plane with a constant acceleration of ( $2.0\hat{i} - 3.0\hat{j}$ ) m/s$^2$. At the instant the particle reaches its maximum *y* coordinate, find its velocity.

A) 4.0 m/s in the + *x* direction
B) 6.0 m/s in the + *x* direction
C) 8.0 m/s in the + *x* direction
D) 12 m/s in the + *y* direction
E) zero

---

Q12.

A ball is thrown from the top of a building with an initial velocity of 8.00 m/s making an angle of 20.0° below the horizontal, as shown in **Figure 4**. It strikes the ground 3.00 s later. Find the height from which the ball was thrown.




A) 52.3 m
B) 26.5 m
C) 72.2 m
D) 9.80 m
E) 35.0 m

---

Q13.

A stone is tied to the end of a string and is rotated with constant speed in a horizontal circle of radius 1.52 m. It makes two complete revolutions each second. What is the magnitude of its acceleration?

A) 240 $m/s^2$
B) 0.240 $m/s^2$
C) 24.0 $m/s^2$
D) 2.40 $m/s^2$
E) 2400 $m/s^2$

---

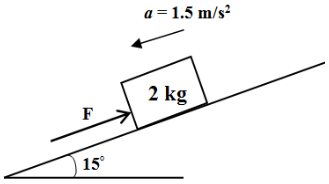
Q14.
A car travels due east with a speed of 10.0 m/s. Rain is falling vertically relative to the earth with a speed of 5.00 m/s. At what angle from the vertical direction does the rain appear to be falling as observed by the driver of the car?

A) 63.4°
B) 26.6°
C) 24.1°
D) 41.8°
E) 85.2°

---

Q15.

A 2.0 kg block sides down a frictionless 15° inclined plane. A force ( $\vec{F}$ ) acting parallel to the incline is applied to the block (see **Figure 5**). If the acceleration of the block is 1.5 m/s$^2$ down the incline, what is the magnitude of $\vec{F}$ ?




A) 2.1 N
B) 8.1 N
C) 3.0 N
D) 4.3 N
E) 6.2 N

---

Q16.

A 1.5 kg object has a velocity of $5.0\hat{j}$ (m/s) at time $t$ = 0. It is accelerated at a constant rate for 5.0 s, after which it has a velocity of $6.0\hat{i}+12\hat{j}$ (m/s). What is the magnitude of the net force acting on the object during this time interval?

A) 2.8 N
B) 3.9 N
C) 4.3 N
D) 1.1 N
E) 9.8 N

---

Q17.

A certain force when applied to mass $m_1$ gives an acceleration of 12.0 m/s$^2$, and when applied to mass $m_2$ gives an acceleration of 3.30 m/s$^2$. What acceleration would the same force give when applied to an object of mass $m_{1+}m_2$?

A) 2.59 m/s$^2$
B) 6.00 m/s$^2$
C) 7.65 m/s$^2$
D) 8.70 m/s$^2$
E) 15.3 m/s$^2$

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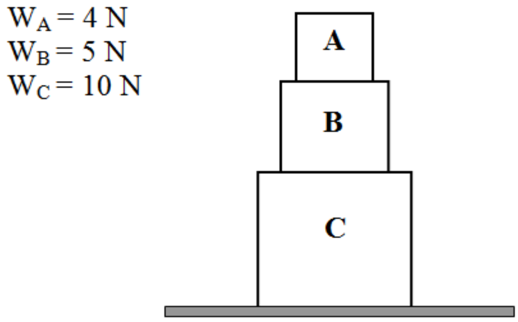
Q18.

Three blocks (A, B, and C) rest on a table, as shown in **Figure 6**. The weight of each block is indicated on the figure. The force of block C on block B has a magnitude of

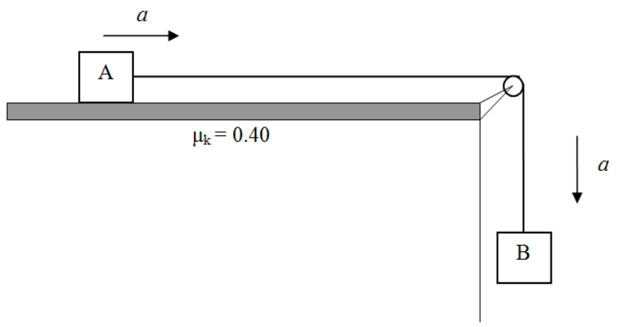



A) 9.0 N
B) 19 N
C) 14 N
D) 5.0 N
E) zero

---

Q19.

Block A, with a mass of 50 kg, rests on a horizontal surface. The coefficient of kinetic friction between the block and the surface is 0.40. A massless string connects block A through a massless frictionless pulley to another block B of mass 30 kg, as shown in **Figure 7**. What is the magnitude of the acceleration of block B?




A) 1.2 $m/s^2$
B) 2.4 $m/s^2$
C) 0.60 $m/s^2$
D) 3.6 $m/s^2$
E) zero

---

Q20.

The driver of a 1000-kg car tries to turn through a circle of radius 100 m on a flat circular road at a speed of 10 m/s. The frictional force between the tires and the road is 900 N pointing to the center of the circular road. The car will

A) slide off to the outside of the circular road.
B) slide into the inside of the circular road.
C) make the turn only if it goes faster.
D) make the turn without slipping.
E) None of the other answers.