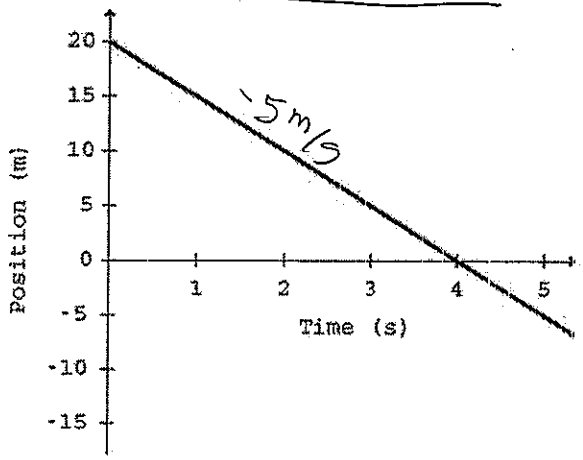
Topic 1C: Constant Velocity

51. The graph below represents the motion of frisbee relative to a person at the 0 position mark. Consider the positive direction to be east.



What is the velocity of the frisbee?

A) 5 m/s west B) 5 m/s east C) 20 m/s east D) 40 m/s east

52. A blinking light of constant period is situated on a lab cart. Which diagram best represents a photograph of the light as the cart moves with constant velocity?

A) B)

C) D)

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53. Which of the following is a vector quantity?

A) time B) displacement C) speed D) distance

54. A wavelength of 500 nm is equivalent to a length of

A) 5×10^{-9}m B) 5×10^{-7}m C) 5×10^{9}m D) 5×10^{-11}m

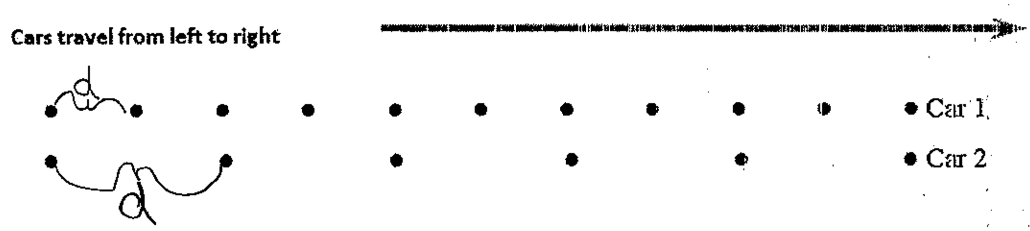
55. A mass of 150,000 grams is equal to

A) 1.5×10^{3} g B) 1.5×10^{5} kg C) 1.5×10^{-5}kg D) 1.5×10^{2}kg

56. Pacman is moving across the screen with a greater eastward component than upward component. A possible angle of displacement is

A) 60 degrees B) 90 degrees C) 45 degrees D) 30 degrees

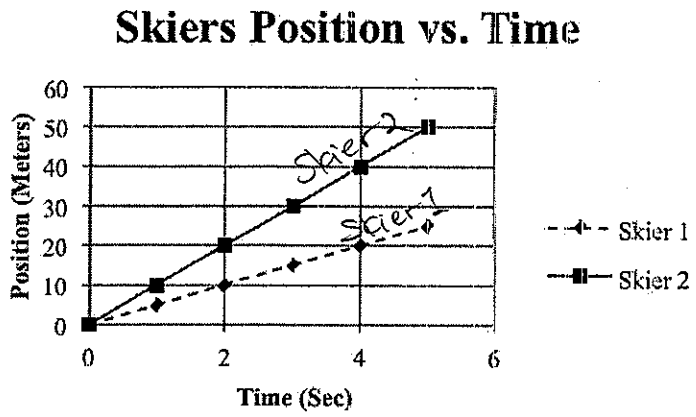
57. The diagram below summarizes the position of Car 1 and Car 2 over a 10m distance



Which of the following is a correct description of Car 1 and Car 2

~~A) Car 1 and Car 2 are slowing down~~
B) Car 2 is going twice as fast as Car 1
~~C) Car 1 is speeding up and Car 2 slowing down~~
~~D) Car 1 is going twice as fast as Car 2~~

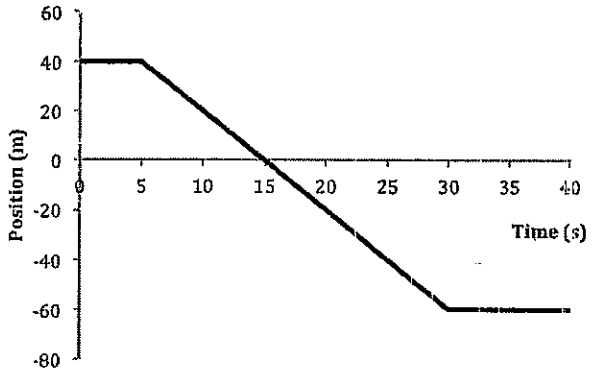
58. The graph below shows the position of skier 1 and skier 2 over a 5 second time period



Which of the following is true statement about the motion of the skiers

A) Both skiers are speeding up
B) Both skiers are slowing down
C) Skier 2 is moving faster than skier 1
D) Both skiers are standing still

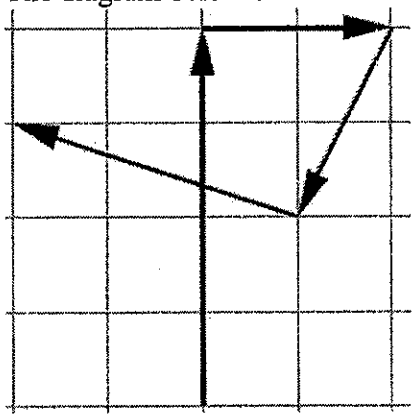
59. The graph below summarizes the position of an object as it moves in a long hallway. The zero position is the location of the observer.



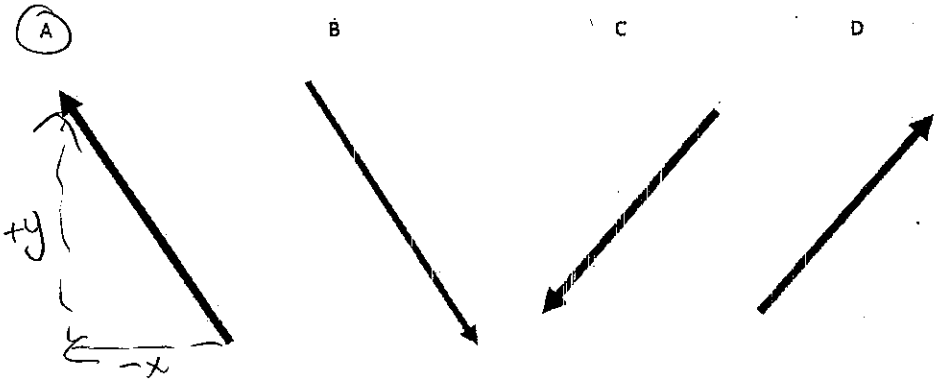
During what time interval is the object to the left of the observer?

A) The entire time
B) 5 to 30 seconds
C) 15 to 30 seconds
D) 30 to 40 seconds

60. The diagram below summarizes the displacement of an ant.



Which of the following represents the resultant displacement of the ant?



61. Scalar is to vector as

(A) speed is to velocity
B) displacement is to distance
C) displacement is to velocity
D) speed is to distance

Vector Scalar
Vector position Vector rate
Scalar rate Scalar position

62. The mass of a paper clip is approximately

A) 1×10^{6} kg B) 1×10^{3} kg (C) 1×10^{-3} kg D) 1×10^{-6} kg

1 g

63. 370μm is equal to

(A) 3.7×10^{-4}m B) 3.7×10^{-6}m C) 3.7×10^{-8}m D) 3.7×10^{2}m

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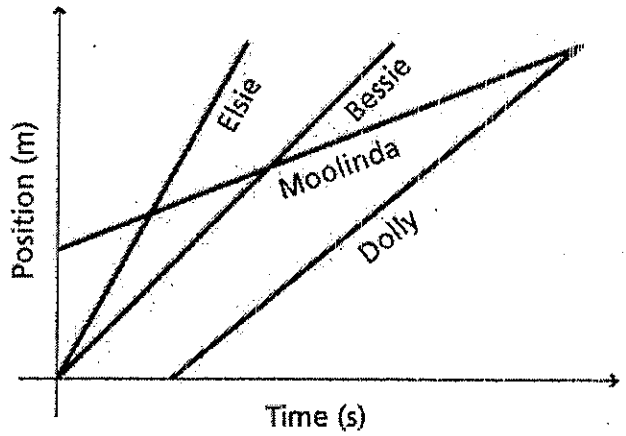
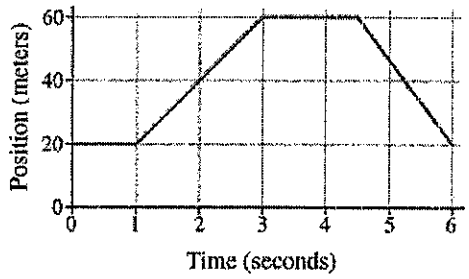
64. The graph below shows the position of 4 cows as a function of time.



Which cow has the greatest speed?

A) Elsie B) Bessie C) Moolinda D) Dolly

65. The graph below shows the motion of student on a skateboard moving on a flat level surface.



The distance covered between 1 and 6 seconds equals

A) 80m B) 40m C) 6m D) 13.3m

4×10^{-7}m 5×10^{3}m

66. What is the difference in **orders of magnitude** between 400nm and 5km?

A) 6 B) 12 C) 10 D) 2

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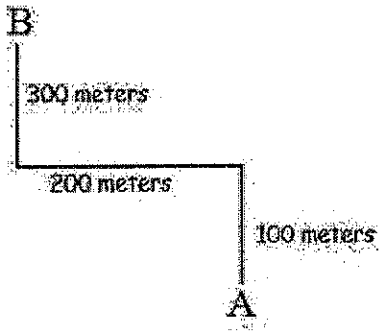
67. The diagram below represents the path of a student through the school.



Compared to the distance traveled by the student, the displacement is

A) less B) more C) the same

68. A robot experiences two concurrent velocities: Vector A has a magnitude of 6 m/s and Vector B has a magnitude of 4m/s. Vector A is directed at north. The smallest resultant magnitude will occur if Vector B is directed

A) south B) north C) east D) west

Smallest magnitude results from opposite direction

A 6m/s @ North B 4m/s @ ?

69. Which of the following vectors has a greater horizontal component than vertical component?

A) 10 m at 60 degrees $y > x$ B) 4 m at 45 degrees $y = x$

C) 8 m at 55 degrees $y > x$ D) 6 m at 35 degrees $x > y$

70. Which of the following is a possible resultant of two concurrent vectors with magnitudes of 6 m/s and 10 m/s?

A) 14 m/s B) 2 m/s C) 60 m/s D) 31 m/s

6m/s + 10m/s @ 0° = 16m/s

6m/s + 10m/s @ 180 difference is 4m/s any number between 16m/s & 4m/s

71. Which of the following correctly expresses the product of $(A \times 10^3)$ and $(B \times 10^{-7})$

A) $AB \times 10^{-21}$ B) $A/B \times 10^{10}$ C) $AB \times 10^{-4}$ D) $AB \times 10^{10}$

72. Which of the following correctly express the result of $(A \times 10^5)$ divided by 200?

A) $(\frac{A}{2} \times 10^3)$ B) $(\frac{A}{2} \times 10^7)$ C) 500A D) $2.5 \times 10^{-5}A$

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73. A moving body must undergo a change of

A) velocity B) acceleration C) position D) direction

74. The speedometer in a car does not measure the car's velocity because velocity is a

A) vector quantity and has a direction associated with it
B) vector quantity and does not have a direction associated with it
C) scalar quantity and has a direction associated with it
D) scalar quantity and does not have a direction associated with it

75. The term "concurrent" refers to

A) Two or more vector quantities that add to a resultant of zero
B) A counter flow in a river or stream
C) The rate of change in position
D) Two or more events happening at the same time

76. A child in a maze travels 3m east, 4m north, 6m west, 2m north, 1m west. What is the child's resultant horizontal displacement?

A) ~~10m east~~ B) ~~16m west~~
C) 4m west D) 4.5 m at 26 degrees north of west

X	y
3m	4m
-6m	2m
-1m	
-4m	6m

77. An object which is traveling back and forth along a vertical line (north/south) would be considered to have a negative velocity if it is

A) slowing down B) traveling northward
C) traveling southward D) at rest

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78. A car travels 90. meters due north in 15 seconds. Then the car turns around and travels 40. meters due south in 5.0 seconds. What is the magnitude of the average velocity of the car during this 20.-second interval?

A) 2.5 m/s B) 5.0 m/s C) 6.5 m/s D) 7.0 m/s

$\text{velocity} = \frac{\text{displacement}}{\text{time}} = \frac{50\text{m}}{20\text{s}}$

79. How long will it take an object to move 100 meters if the object is traveling with an average speed of 0.5 meter per second?

A) 200 s B) 2 s C) 5 s D) 50 s

$d = 100\text{m}$, $v = .5\text{s}$, $t = ?$

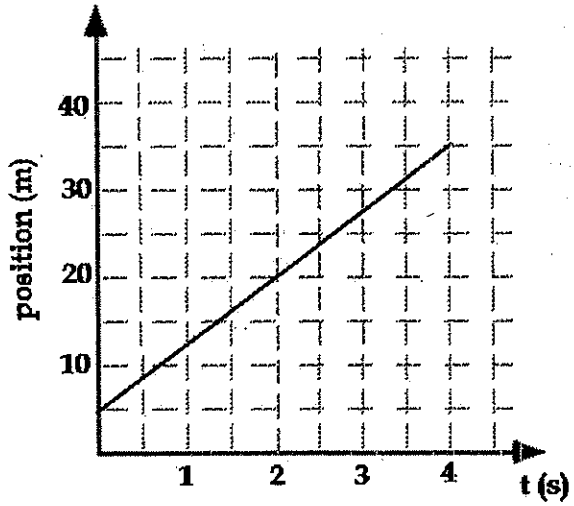
$t = \frac{d}{v} = \frac{100\text{m}}{.5\text{m/s}}$

80. What is the average speed of an object that travels 6.00 meters north in 2.00 seconds and then travels 3.00 meters east in 1.00 second?

A) 9.00 m/s B) 0.333 m/s C) 3.00 m/s D) 4.24 m/s

$\text{Speed} = \frac{\text{distance}}{\text{time}} = \frac{9\text{m}}{3\text{s}}$

81. The graph below represents the position of an object over a 4 second time period.



$v = \frac{\Delta d}{\Delta t} = \frac{\Delta 30\text{m/s}}{4\text{s}}$

What is the speed of the object during this 4 second interval

A) 35 m/s B) 8.75 m/s C) 7.5 m/s D) 4 m/s

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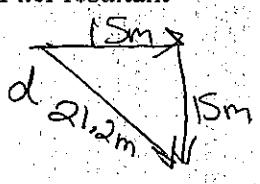
82. A girl attempts to swim directly across a stream 15 meters wide. When she reaches the other side, 5 seconds later, she is 15 meters downstream. What is the magnitude of her resultant **velocity**?

A) 3 m/s B) 4.2 m/s C) 6 m/s D) 21.2 m/s



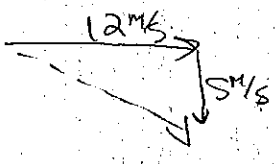
$v = \frac{d}{t} = \frac{21.2m}{5s} = 4.2 m/s$

83. A person walks 5.0 kilometers north, then 5.0 kilometers east. His displacement is closest to

A) 7.1 kilometers northeast B) 7.1 kilometers northwest
C) 10 kilometers northeast D) 10 kilometers northwest

84. A boat heads directly eastward across a river at 12 meters per second. If the current in the river is flowing at 5.0 meters per second due south, what is the magnitude of the boat's resultant velocity?

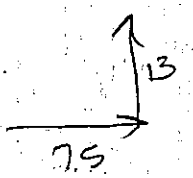
~~A) 7.0 m/s~~ Can't be difference ~~B) 8.5 m/s~~ Can't be Smaller than longest side C) 13 m/s ~~D) 17 m/s~~ Can't be sum



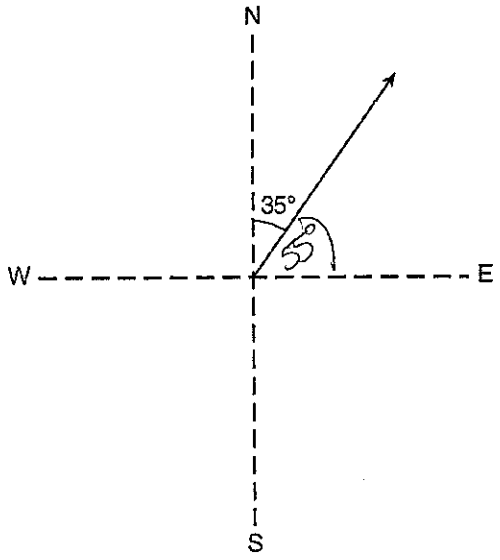
85. The components of a 15-meters-per-second velocity at an angle of 60.° above the horizontal are

A) 7.5 m/s vertical and 13 m/s horizontal
B) 13 m/s vertical and 7.5 m/s horizontal
C) 6.0 m/s vertical and 9.0 m/s horizontal
D) 9.0 m/s vertical and 6.0 m/s horizontal ← magnitudes can't add to sum

y > x



86. The vector diagram below represents the velocity of a car traveling 24 meters per second 35° east of north.



$A_x = A\cos\theta$ → θ between Resultant and x

$24\,m/s \cos 55° = 13.8\,m/s$

What is the magnitude of the component of the car's velocity that is directed eastward?

A) 14 m/s B) 20. m/s C) 29 m/s D) 42 m/s

87. A sailboat heads eastward across a northward current of 3 knots. The resultant velocity of the boat is 5 knots. Determine the direction (relative to east) of the resultant velocity.

A) 15 degrees B) 31 degrees C) 53 degrees D) 37 degrees

$A_y = 3$ knots
$A = 5$ knots
$\theta = ?$

$A_y = A\sin\theta$
$3\text{kn} = 5\text{knot}\sin\theta$ $\theta = 37°$

88. The New Horizons spacecraft travelled 4.76×10^9 km in 3,462 days as it approached the dwarf planet Pluto. What is the approximate average speed of the spacecraft?

A) 1.4×10^9 m/s B) 9.5×10^5 m/s
C) 1.6×10^{13} m/s D) 1.6×10^4 m/s

d $4.76\times10^9 km = 4.76\times10^9 \times 10^3 m = 4.76\times10^{12} m$

$t = 3462\,days \times \frac{24\,hrs}{1\,day} \times \frac{3600\,s}{1\,hr} = 299116800\,s$

$V = \frac{d}{t} = \frac{4.76\times10^{12}\,m}{2.99\times10^8\,s}$

$= 1.59\times10^4\,m/s$

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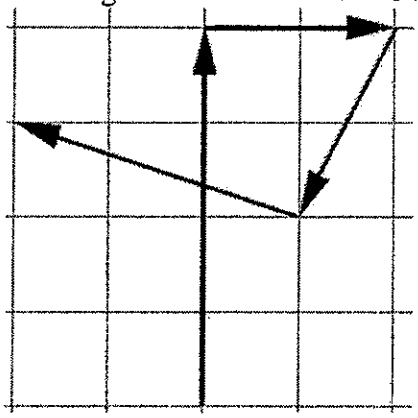
89. The diagram below summarizes the displacement of an ant.



Which of the following correctly represents the angle of the resultant relative to east?

A) 303.7 degrees
B) 56.3 degrees
C) 213.7 degrees
D) 123.7 degrees

90. Which of the following is the resultant displacement of an object that travels 12m east, 9m north, 4m west and 1m south?

A) 18.9m at 53 degrees
B) 18.9m at 37 degrees
C) 11.3m at 45 degrees
D) 26 m at 45 degrees

x	y
12 m	9m
−4m	−1m
8m	8m

91. A duck swimming east at 2 m/s is pushed in a direction of 30° relative to her starting point by northward current. What is the magnitude of the resultant displacement?

A) 3.5 m/s
B) 4 m/s
C) 2.3 m/s
D) 1.7 m/s

$A_x = 2\ m/s$
$\theta = 30°$

$A_x = A\cos\theta$
$2\ m/s = A\cos 30°$

92. What is the distance traveled by a cosmic ray that travels at a speed of 1.4×10^8 m/s for a time of 2 millisecond?

A) 2.8×10^8 m
B) 7×10^7 m
C) 7×10^{10} m
D) 2.8×10^5 m

$d = ?$
$v = 1.4 \times 10^8\ m/s$
$t = 2 \times 10^{-3}\ s$

$d = vt$
$= 2.8 \times 10^5\ m$

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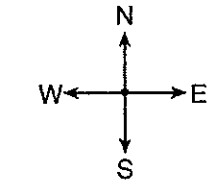
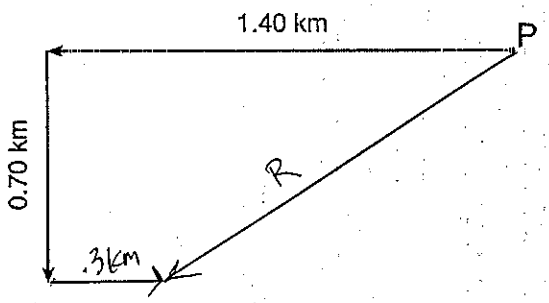
Base your answers to questions **93** through **97** on the information below.

A girl rides her bicycle 1.40 kilometers west, 0.70 kilometer south, and 0.30 kilometer east in 12 minutes. The vector diagram below represents the girl's fist two displacements in sequence from point *P*. The scale used in the diagram is 1.0 centimeter = 0.20 kilometer.



Scale
1.0 cm = 0.20 km



93. Starting at the arrowhead of the second displacement vector, draw a vector to represent the 0.30 kilometer east displacement. Label the vector with its magnitude.

94. Determine the measure of the angle, in degrees, between the resultant and the 1.40-kilometer displacement vector. 33° south of east

95. Draw the vector representing the resultant displacement of the girl for the entire bicycle trip *and* label the vector *R*.

96. Determine the magnitude of the girl's resultant displacement for the entire bicycle trip, in kilometers.

x	y
−1.4 km	−.7km
+.3km	

−1.1km | −.7km

$A = \sqrt{A_x^2 + A_y^2}$

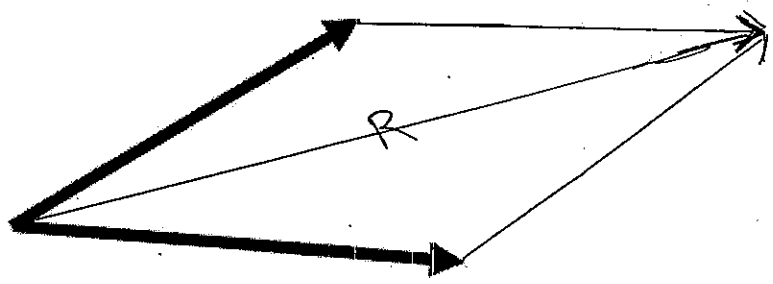
$A = \sqrt{1.1^2 + .7^2} = 1.3\text{km}$

97. Calculate the girl's average speed for the entire bicycle trip. [Show all work, including the equation and substitution with units.]

$\text{Speed} = \frac{\text{distance}}{\text{time}} = \frac{1.4\text{km} + .7\text{km} + .3\text{km}}{12\text{min}} = \frac{.2\text{ km}}{\text{min}}$

$\frac{.2\text{km}}{\text{min}} \times \frac{1000\text{m}}{1\text{km}} \times \frac{1\text{min}}{60\text{s}} = 3.33\text{m/s}$

98. Draw the resultant for the vectors shown below



99. Convert 25 km/hr into m/s using the process of dimensional analysis. [1pt for correct answer, 1 pt for work using dimensional analysis]

$$\frac{25\text{km}}{\text{hr}} \times \frac{1000\text{m}}{1\text{km}} \times \frac{1\text{hr}}{3600} = \frac{25000}{3600\text{s}} = 6.9\ \text{m/s}$$

100. Express the value 35 km in meters and correct scientific notation.

$3.5 \times 10^4 \text{m}$

101. A boat moving east at 3.5m/s (A_x) encounters a current moving north. The resultant velocity of the boat is 7 m/s. What is the resultant direction of the boat of the boat? [Show all work, including equation and substitution with units]

$A_x = 3.5\text{m/s}$ $\quad A = 7\text{m/s}$ $\quad \theta = ?$

$A_x = A\cos\theta$

$3.5\text{m/s} = 7\text{m/s}\cos\theta$

$\theta = 60°$

102. A computer cursor moves 4 clicks right, 2 clicks up, 3 clicks left and 1 click up. Find both the distance traveled and the magnitude of the displacement in terms of clicks. (Show all work for the displacement calculation, including equation and substitution with units.)

x	y
4cl	2cl
-3cl	1cl
1cl	3cl

$$R = \sqrt{R_x^2 + R_y^2}$$

$$R = \sqrt{(1\text{cl})^2 + (3\text{cl})^2}$$

$R = 3.16$

$$\theta = \tan^{-1}\left(\frac{R_y}{R_x}\right)$$

$$\theta = \tan\left(\frac{3\text{cl}}{1\text{cl}}\right)$$

$\theta = 71.6°$