Physics 30S
Unit 1 – Kinematics

Mrs. Kornelsen

Teulon Collegiate Institute

Grade 11 Physics – Math Basics

Answer the following questions. Round all final answers to 2 decimal places.

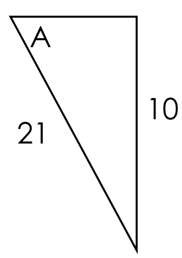
Algebra

1. Rearrange the following equations for the variable stated.
   a. Rearrange $\lambda = \frac{\Delta x d}{L}$ to solve for d.

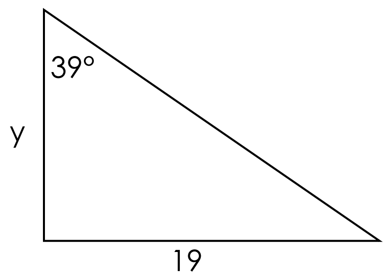
   b. Rearrange $v = \frac{\lambda}{T}$ to solve for T.

Trigonometry

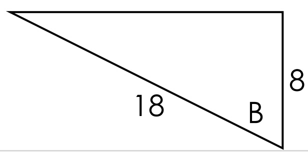
2. Calculate the unknown variable for each of the following right triangles:
   a.



   b.



   c.



Using Your Calculator

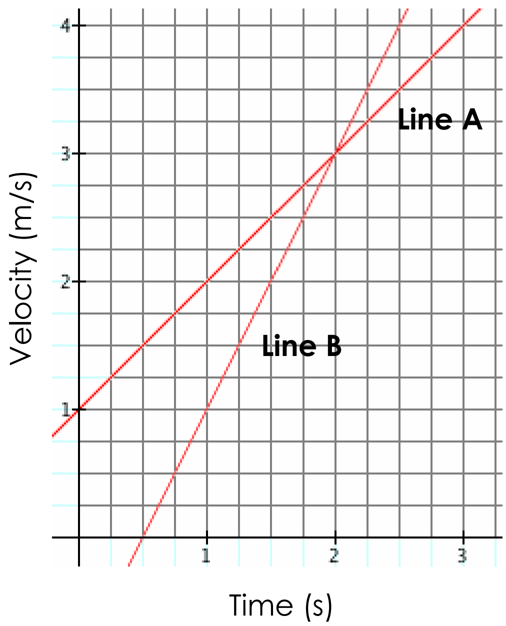
3. Use your calculator to solve the following:

   a. $\frac{15.2(31.4-5.5)}{6.2}+125=$ ________________

   b. $\frac{22.1\tan(66)+33}{3.6}=$ ________________

Linear Graphs

4. Use the following graph to answer the questions below.



   a. Calculate the slope of Line A.

   b. Calculate the slope of Line B.

More Trigonometry Review:

Using Trigonometry To Find Lengths

Date________________ Period____

Find the missing side. Round to the nearest tenth.

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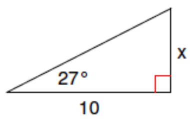

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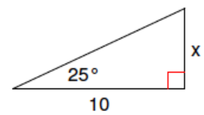

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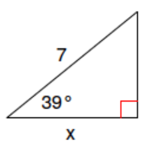

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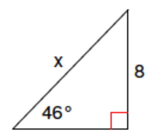

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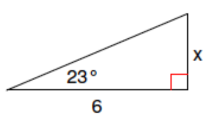

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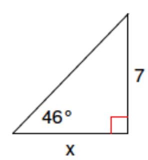

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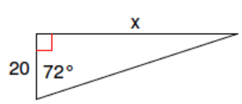

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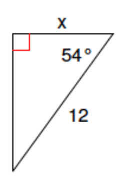


Using Trigonometry to Find Angle Measures

Date________________ Period____

Find each angle measure to the nearest degree.

1) tan A = 2.0503

2) cos Z = 0.1219

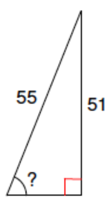
3) tan Y = 0.6494

4) sin U = 0.8746

5) cos V = 0.6820

6) sin C = 0.2756

Find the measure of the indicated angle to the nearest degree.

7)


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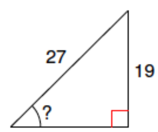

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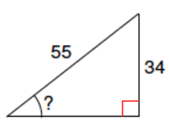

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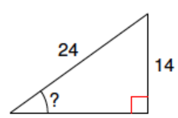

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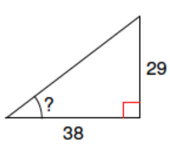

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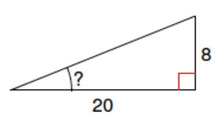

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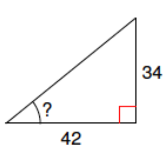

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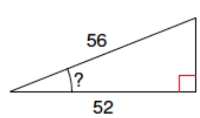


Grade 11 Physics – Physics Skills

There are several very important Physics skills you will be expected to use during this course and they will appear frequently. This is an overview of a few of those skills.
You may have seen some of these in previous courses.

Scientific Notation – Standard Form and Scientific Notation

In math, **standard form** is the way numbers are normally written, for example 315000000 or 0.0000046 are numbers written in standard form. Generally in physics, when numbers are very big or small, we don't write them in standard from, but in scientific notation. **Scientific notation** is a way of writing a number using a power
of 10.

Example: Convert 315000000 to scientific notation.

Example: Convert 0.0000046 to scientific notation.

Example: Convert 6.35×10^{-9} to standard form

Scientific Notation – Using Calculators

When using your calculator to perform calculations with numbers in scientific notation, you must use the correct button. **DO NOT** use the 10^x button or y^x button. You must always use your exponent button. On must calculators, it is an **EXP** button or **EE** button. This button allows you to skip typing in ×10 on your calculator.

Example: $(2.81 \times 10^8)(6.38 \times 10^3)$ = ___________________________

Example: $(6.267 \times 10^4) \div (2.6 \times 10^{-3})$ = ___________________________

Unit Conversion

In Physics, units that are used for calculations need to be kilograms (kg),
metres (m), seconds (s) and Newtons (N). If information in questions is not given using these units, the number must be changed so it is in these units.

To convert information, set up a fraction that allows the unwanted units to cancel out.

Remember: 1km = 1000m, 1hour = 60 minutes, 1minute = 60s

Example: Convert 100km to metres.

Example: Convert 5hours to seconds.

Example: Convert 4km/h to m/s.

Prefixes

Prefixes are used as another way to write scientific notation. The prefix replaces the exponent part of the number.

Prefix	Symbol	Multiplier	
exa	E	10^{18}	1,000,000,000,000,000,000
peta	P	10^{15}	1,000,000,000,000,000
tera	T	10^{12}	1,000,000,000,000
giga	G	10^{9}	1,000,000,000
mega	M	10^{6}	1,000,000
kilo	k	10^{3}	1,000
hecto	h	10^{2}	100
deka	da	10^{1}	10
deci	d	10^{-1}	0.1
centi	c	10^{-2}	0.01
milli	m	10^{-3}	0.001
micro	μ	10^{-6}	0.000,001
nano	n	10^{-9}	0.000,000,001
pico micro micro	p $\mu\mu$	10^{-12}	0.000,000,000,001
femto	f	10^{-15}	0.000,000,000,000,001
atto	a	10^{-18}	0.000,000,000,000,000,001

Example: 5.0×10^{-6} m = _________________ µm

Example: 6.4×10^{9} L = _________________ GL

Example: 26 Ms = _________________ s

Example: 15 nm = _________________ m

Sometimes the decimal place will need to be changed before using a prefix. This will be necessary when the exponent part of the number does not fit into one of the prefix categories.

Remember: When you move the decimal to the right, the exponent becomes smaller. When you move the decimal to the left, the exponent becomes bigger.

Decimal Moves: ⟵⟶

Exponent Becomes:

Example: 22×10^{8} s = _________________ Gs

Example: 6.44×10^{-7} m = _________________ nm

Example: 44 cm = _________________ hm

Homework

Pg. 15 #1

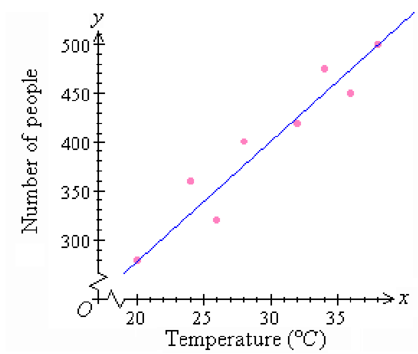
Pg. 30 #15-17

Prefixes Exit Slip

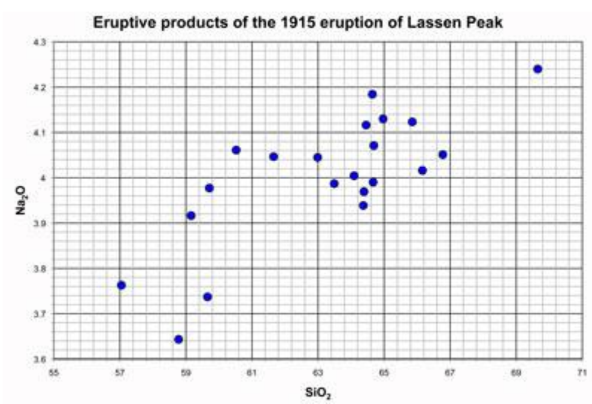
Graphs – Lines of Best Fit

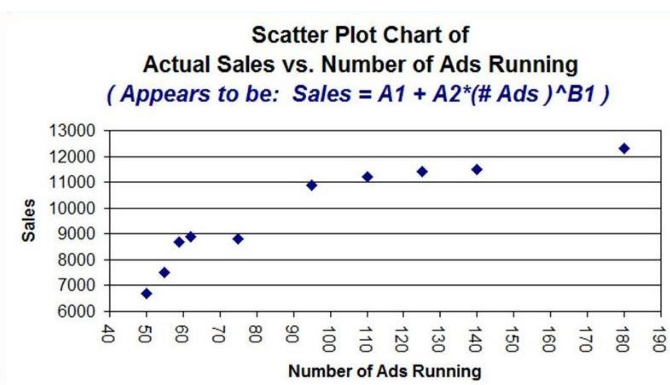
When performing an experiment, results will never be perfect because there is always some error. This means if you're graphing your data, it will never be a "perfect graph". For example, if there is a linear relationship, probably your graph won't be a perfectly straight line, but close to one. When asked to draw a graph, **never** just "connect the dots", this does not show the relationship in the data. Always look for a general pattern in the data and draw the **line of best fit**, which is a line that shows the relationship. A line of best fit does not always have to be a straight line, it can also be a curve, but think about the data carefully when deciding this, and think about the experiment you just did. Think about graphs you've done in math, if your line of best fit doesn't look like a graph from math class, it's probably not the correct line of best fit.

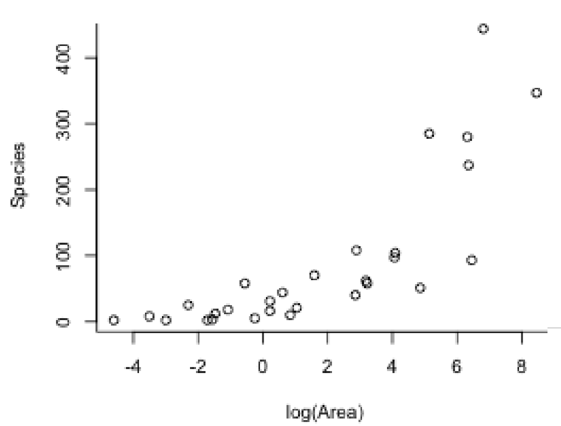
The graph below has a good line of best fit drawn on it:

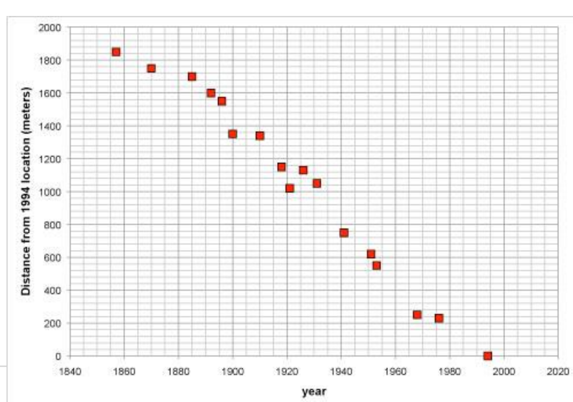


Examples: Draw the line of best fit for the following graphs



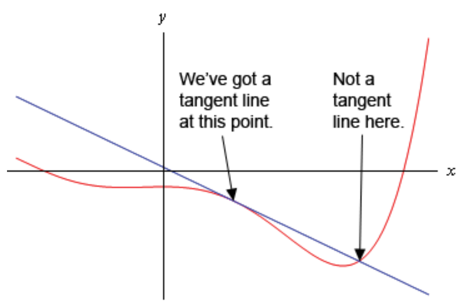


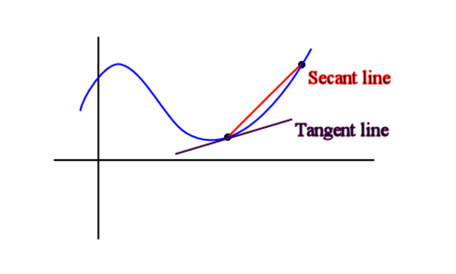




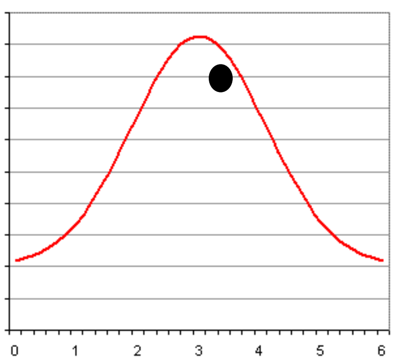
Graphs – Tangent Lines

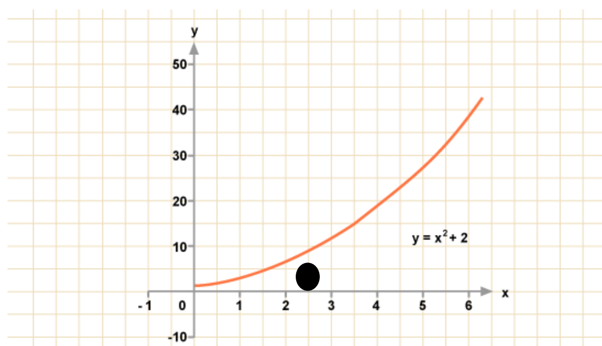
A **tangent line** is a line that touches a curve at only **one** point without crossing over it. If you imagine the curve is part of a circle, the tangent line is perpendicular to the radius of that imaginary circle. A tangent line describes the graph at only a single location.

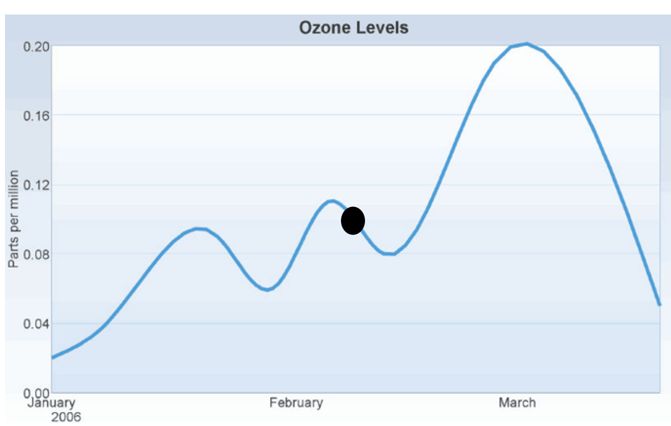


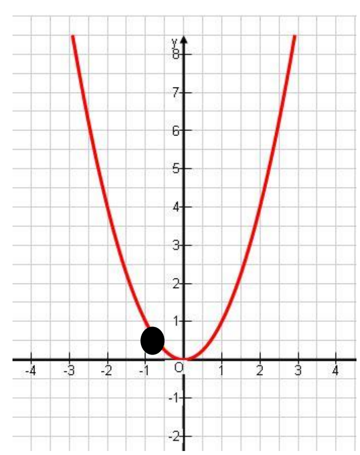


Examples: Draw a tangent line at the point indicated on each graph.









Significant Figures
(Sig Figs)

Purpose

Science requires reporting results as accurately as possible. To determine how accurate a number, we use a method called significant figures. Significant figures are a way of counting how many digits or decimal places are known to be accurate. When we know how many digits are accurate, we can decide how to round our final answer. There are five rules we use to count how many digits are significant:

Rule 1:

Numbers from 1 – 9 are always significant.

Example	# of Sig Figs	Comment
453	3	All non-zero numbers are always significant.
195638	6	
25.95	4	

Rule 2:

All zeros between non-zero digits are always significant.

Example	# of Sig Figs	Comment
806	3	The zeros are surrounded by non-zeros, so they are significant.
90502	5	
25.00095	7	

Rule 3:

Leading zeros in a number with a decimal are not significant. Leading zeros are zeros (and only zeros) on the left side of a number.

Example	# of Sig Figs	Comment
0.46	2	Zeros on the left side are not significant.
0.000255	3	
0.04506	4	

Rule 4:

Trailing zeros (zeros on the right side of a number) are only significant if there is a decimal point in the number.

Example	# of Sig Figs	Comment
1000	1	Zeros on the right side are not significant if there is no decimal.
15020	4	
3510.0	5	

Rule 5:

When numbers are greater than 1, trailing zeros are not significant, unless stated so.

This is a special situation that can occur when numbers have been rounded. To solve this problem, write the number of sig figs in brackets after the answer, or convert your answer to scientific notation.

Example: Round 2961 to two significant figures
Answer: 3000 (2 sig figs) or 3.0×10^3

When using scientific notation, use the rules stated above, but do not count the exponent part when counting significant figures.

Example	# of Sig Figs	Comment
200 (2 Sig Figs)	2	State if zeros are significant or use scientific notation.
4.100×10^6	4	
7.00×10^2	3	

Practice Problems #1: For each of the following, state the number of sig figs

	# of Sig Figs
50101	
300	
1.0001	
1.0	
0.000874215	
600 (2 Sig Figs)	
285623	
1000937	

	# of Sig Figs
10400	
7.03810	
3.0×10^6	
0.0909	
37	
9260.0	
9027000	
7.2000×10^3	

Adding and Subtracting

When adding or subtracting, your answer must have as many decimal places as the value having the fewest number of decimal places in the question.

Hint: When adding and subtracting, don't think about the number of sig figs, just think about decimal places!

Example	Answer	# with Least Decimal Places	Final Answer
8.20 + 2	10.20	2	10
39.3 – 0.804	38.496	39.3	38.5
297.972 + 4.1 – 0.20	301.872	4.1	301.9

Multiplying and Dividing

When multiplying or dividing, your final answer can only have as many sig figs as the value having the least number of sig figs in the question.

Hint: Count the sig figs for each number in the question!

Example	Answer	# with Least Sig Figs	Final Answer
0.00005 x 538	0.0269	0.00005	0.03
8.5 ÷ 0.356	23.87640449	8.5	24
7.6 x 21.9	166.44	7.6	170

Note: For questions that combine addition, subtraction, multiplication and division, use the method for multiplying and dividing when rounding your final answer.

Practice Problems #2: For each of the following, answer the question and round your answer correctly

	Answer
100 x 8.57	
13.59 + 23.25 + 20	
53.4028 – 14	
6008 ÷ 8.724	
6.1 + 14.67 – 3.322	

	Answer
72 ÷ 7	
12.8 x 5.2	
91.68 – 19.1	
42.828 + 67.4629	
600 ÷ 38	

Counting Significant Figures

Count the number of Sig Figs for each of the following numbers:

	# of Sig Figs
700	
45136	
600.0	
690	
108	
550	
0.000730	
566.90	
2001	
5.0×10^{2}	
500	
607	
2.01×10^{4}	
432.000	
81	
80	
1.00×10^{3}	
65	
201	
192	
5400	
100.0	
7.29	
0.000004	
8000000	
0.010060	
10.02	
22	
357	
400	
0.00530	
320	

	# of Sig Figs
5.0×10^{8}	
4.23×10^{5}	
46800	
126.48	
2.00×10^{10}	
1.0005	
90.0	
9.2×10^{-5}	
7000	
450.0	
250	
305	
0.006200	
565.05	
5500	
74.00	
7040.0	
23.7×10^{-2}	
4301.0	
0.00056	
1.4×10^{7}	
4.293×10^{4}	
40280	
33214	
705	
600	
2.003	
200.0	
0.0001	
218	
4755.50	
22568	

Calculations with Significant Figures

Calculate the following, be sure to round answer to the correct number of significant figures.

	Answer
4.60 + 3	
2.15 x 3.1 x 100	
80 ÷ 0.675	
1.0007 x 0.009	
75 – 2.55	
38 ÷ 7	
0.008 + 0.05	
500000 ÷ 5.002	
13.7 x 2.5	
410 + 3.300	
22.4420 + 56.981	
200 – 87.3	
500009 ÷ 17.000	
50.0 x 2.00	
4.56 x 9.000 ÷ 4.601	
74.160 – 4.8 – 0.470	
5.00009 x 0.06	
5003 ÷ 3.781	
6.790 – 2	
18.640 + 670.445	
67.5 – 0.009	
5.5 + 3.7 + 2.97	
300 x 10.6	
71.86 – 13.1	
51 ÷ 7	
(59.3 ÷ 0.0054) + 1	
200 x 3.58	
640 – 627.03	
357.89 + 0.002	
65 x 0.000837	
835 ÷ 0.040621	
(34 + 5.02) ÷ 2.222	

	Answer
0.059 x 6.95	
5000 ÷ 55	
2.25 + 6	
3.48 + 53.252 + 0.601	
10 – 9.9	
0.003 ÷ 106	
47 x 2.56 ÷ 1.090	
2.3 x 3.45 x 7.42	
2.2 + 4.26 – 0.00003	
38.000 ÷ 4.4	
7000.40 + 6.2 + 6.32	
1000 x 0.000041	
87.003 + 7.00	
0.70 – 0.1	
45.2 + 1.444 – 2.2	
17.95 + 32.42 + 50	
89 ÷ 9.0	
0.04 + 2.7	
6.790 – 2.5	
0.00003 x 727	
6.7 + 30030 – 12220	
0.003 ÷ 5	
97.0 x 2.00756	
84.675 – 3	
$(4.63 \times 10^5) \div (2.5 \times 10^5)$	
3.14 x 5.6	
208 ÷ 9.0	
12.09 – 6.7	
89.010 x 70.00	
52.00 ÷ 7.30	
3.01 + 2.151	

p. 13 #2-5

Do: Physics Skills Assignment

Grade 11 Physics – Angles

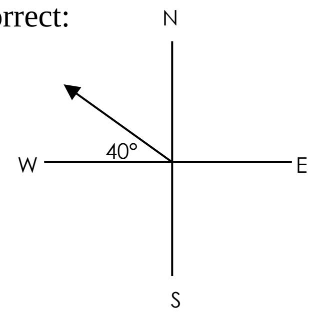
When working with vectors, it is very important to be specific about the direction of that vector. When vectors have angles, there are two ways to indicate the direction, you may use either technique.

When labeling the direction of the angle, always remember to consider where that angle is being

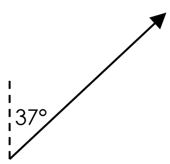
_______________________ and which direction it _________________________.

The angle for the vector on the right can be written in four different ways.
Any of these methods is considered to be correct:

1. [W40°N]
2. 40° NW
3. [N50°W]
4. 50° W of N



Example: What is the direction of the following vector?



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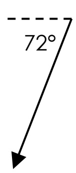

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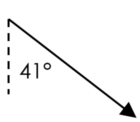


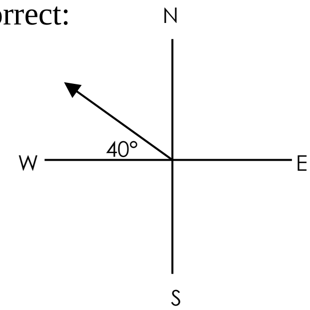
Grade 11 Physics – Angles

When working with vectors, it is very important to be specific about the direction of that vector. When vectors have angles, there are two ways to indicate the direction, you may use either technique.

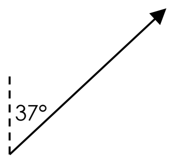
When labeling the direction of the angle, always remember to consider where that angle is being measured from and which direction it moves away.

The angle for the vector on the right can be written in four different ways.
Any of these methods is considered to be correct:

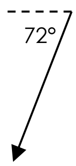
1. [W40°N]
2. 40° NW
3. [N50°W]
4. 50° W of N



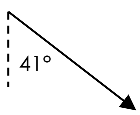
Example: What is the direction of the following vector?



Example: What is the direction of the following vector?

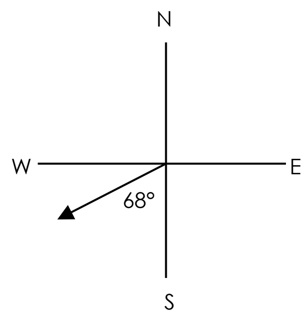


Example: What is the direction of the following vector?

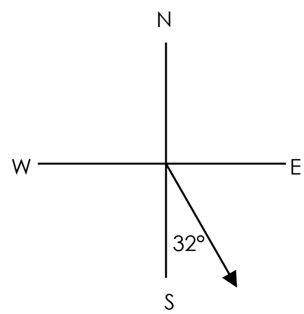


Grade 11 Physics – Angles

1. Express each of the given angles four different ways:
   a.

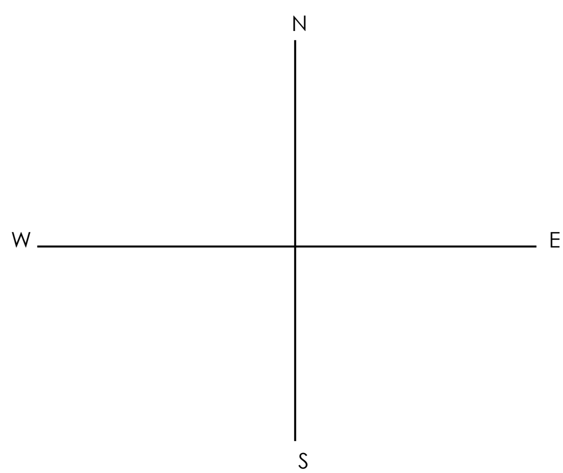


   b.



2. The vector [N20°W] is identical to which of the following vectors?
   a. [W70°N]   b. [W60°N]   c. [W80°N]   d. [E30°S]

3. Draw the following vectors:
   a. [E35°S]
   b. 50° W of N
   c. [S5°E]
   d. 80° E of N
   e. [S43°W]
   f. 7°NE

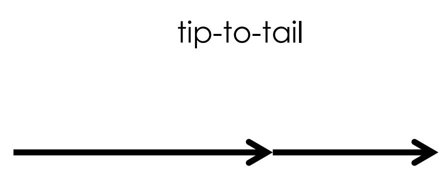


Grade 11 Physics – Scalars and Vectors

Scalars

Vectors

Vector Addition is the process of drawing arrows to symbolize a vector. When adding multiple vectors, the arrows must be drawn one after another and placed tip-to-tail, as shown on the following diagram on the right.



The Resultant vector, $\vec{R}$, is the answer and points from the beginning to the end of the chain of vectors.

Example: Add 3.0m [South] and 5.0m [South]

Example: Add 3.0m [West], 6.0m [West] and 4.0m [East]

Grade 11 Physics – Vectors with Angles

Vector addition can also be performed for vectors that are more complicated. Vectors with angles cannot just be added like other vectors. There are two different methods that can be used when solving vector addition problems when angles are involved.

1. Vector Addition with Scale Diagrams

Vectors addition problems with angles can be solved using a scale diagram. This involves drawing an accurate representation of the vectors and measuring the resultant (or the answer).

Steps to follow when using Scale Diagrams for Vector Addition:

1. Choose a scale for the diagram (the vectors should be able to fit onto a page).
2. Determine the scale length of each vector.
3. Draw the vectors tip-to-tail. Be sure to measure the correct angles and scale lengths of each vector.
4. Draw the resultant vector from the beginning of the vector chain to the end.
5. Measure the scale length of the resultant vector and determine the actual length.
6. Measure the angle of the resultant vector.

Example: add 200.0m [North] and 300.0m [30.0° NE] using a scale diagram.

Example: add the following vectors using a scale diagram.

2. Vector Addition with Components

When adding vectors, the "path" the vectors take do not really matter. Remember the resultant (or the answer) is from the start of vector addition to the end. When dealing with vectors that have angles, we can create a new "path" of vectors that will give us the same result, but will be easier for us to work with.

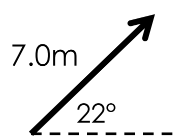
Components are vectors that are parallel to the x or the y axis of a grid and can be used to create a new "path" for our vector. They are called the x-component and the
y-component. They create a right triangle from the original vector, with the original vector as the hypotenuse side of the triangle.

When using the component method, trig ratios will need to be used to determine the magnitude of the x and y components.

Remember: SOHCAHTOA

$$\sin\theta = \frac{opposite}{hypotenuse} \quad \cos\theta = \frac{adjacent}{hypotenuse} \quad \tan\theta = \frac{opposite}{adjacent}$$

Example: Break the following vector into x and y components



Steps to follow when using Components for Vector Addition:

1. Create a right triangle with the vector. Be sure to label the directions.
2. Calculate the x and y components.
3. Add or subtract the vectors in the x-direction.
4. Add or subtract the vectors in the y-direction.
5. Create a new right triangle with the numbers found in Steps 3 and 4
6. Calculate the hypothesis side of the triangle and the angle. This is your final answer.

Example: Add the following vectors using components

Example: Add the following vectors using components

Pg. 31 #23, 24

Pg. 84 #1, 2

Pg. 114 #13

Prepare for quiz

Grade 11 Physics – Distance and Displacement

This unit will involve studying **kinematics**, which is a branch of Physics that deals with describing ______________ in a way that doesn't consider the _______________ involved in the motion. This year we will mainly be describing straight line motion with equations.

Distance

Distance, d, is a measure of ____________________ an object moves without reference to the direction it moves (this means it is a scalar value).

Displacement

Displacement, $\Delta\vec{d}$, describes the ____________________ in position of an object during a time interval. It is described by the magnitude and direction of the change in position. It is a __________________.

Note: Δ is the Greek symbol delta. It is used to describe a ___________________ in something. For displacement, it is used to describe a change in position. To use this symbol, always take the final value and subtract the initial value to determine the difference (or the change).

$$\Delta\vec{d} = \vec{d}_{final} - \vec{d}_{initial}$$
$$\Delta\vec{d} = \vec{d}_2 - \vec{d}_1$$

Directions

When working with vectors, directions are very important and must be considered in calculations. Different directions are indicated by _________________ and ________________. When solving a problem involving vectors, be sure to always first indicate which direction will be represented by a positive or negative.

A reference point must also be determined before solving a problem. To do this we pick a __________________ point and all measurements are made from that location. This is just like a math problem involving a number line, all numbers are measured from the zero position (in Physics, zero is the reference point).

Example: You are in Steinbach and decide to go for a drive one Saturday afternoon. You drive 8.0km [South] of Steinbach when you decide to turn around and drive 13.0km [North]. What is your distance and displacement?

Example: You decide to walk to your friend's house. You walk 1.2km [East] and then 2.2km [North]. What is your distance and displacement?

Grade 11 Physics – Displacement and Distance

Part A.

1. A windsurfer positions their board 3 m behind a buoy and gets blown to a point 2.2 m behind it. Find the displacement.

2. The symbol "△" has other uses.
   a) The mass of a person on a fitness program goes from 90 kg to 80 kg. Find Δm.
   b) A company's balance sheet shows a profit of -$2000 one year. (In other words, they lost money.) The next year, their profit is +$4000. Find ΔP.

3. A plane starts out 15 km south of the airport and undergoes a northern displacement of 18 km. What is its final position?

4. A taxi in Winnipeg begins its day at Portage and Main. It drives 11 km west of this point but then reverses direction and winds up 3km east of the corner. Find the distance it travelled and also its final displacement.

Part B.

1. A missile is fired from a submarine. After undergoing an upwards displacement of 575 m, it strikes its target at an elevation of 535 m.
   a) What was the missile's initial elevation?
   b) Could the missile have possibly travelled a distance greater than 575 m? Explain with a diagram.
   c) In doing this question, where do you assume your frame of reference to be? (In other words, where is the "zero" position for the number line?)

2. A circular track has a diameter of 100 m. A distance runner completes 1 lap in 40 s.
   a) Find the displacement they undergo during this 40 s.
   b) What distance do they travel during this same time interval?

Grade 11 Physics – Speed and Velocity

Speed

Speed, v, is how fast an object is travelling without any consideration of the ________________ of its motion. It is a scalar value. It is calculated by using the ___________________ an object moves in some amount of time. The units of speed are usually m/s.

Uniform Speed is when the speed ___________________ change; it stays the same during the whole time interval. It is calculated using the following formula.

Non-Uniform Speed is when the speed of an object ___________________ during the time interval. When this occurs, we calculate the *average* speed, v_{avg} . The formula used to calculate average speed is the same as uniform speed, the speed is just labelled as being average.

Velocity

Velocity, $\vec{v}$, is how fast an object is moving in a specific direction. It is a _________________. It is calculated by using the _______________________ of an object in some amount of time. The units of velocity are the same as speed, m/s.

Uniform Velocity is when the velocity does not change; it stays the same during the whole time interval. It is calculated using the following formula.

Non-Uniform Velocity is when the velocity of an object changes during the time interval. When this occurs, we calculate the *average* velocity, $\vec{v}_{avg}$. The formula used to calculate average velocity is the same as uniform velocity, the velocity is just labelled as being average.

Direction of Velocity

When calculating velocity (or average velocity), be sure to always indicate what direction an object is moving. The velocity of an object is always in the same direction as the ____________________ of the object. When performing calculations of velocity, be sure to always label a positive and negative direction.

Example: During a 3.00s time interval, a runner's position changes from 50.0m away from the finish line of a race to 30.5m away from the finish line. What is the runner's average velocity?

Example: A car is travelling East at 25.0m/s. It begins 1.00km [East] of Steinbach. How far away from Steinbach is the car 30.0s later?

Example: A person decides to go outside for a jog. They run 1.5km [South] of their home in 15 minutes and then turn around and run 1.2km [North] in 12 minutes and stop to take a break. What is the average speed of the person and the average velocity? (Give the answers in m/s)

Grade 11 Physics – Speed and Velocity

1. What is the average velocity of an airplane that experience a displacement of 900m [South] in 3s?

2. A car has a velocity of 40m/s [South]. What is its displacement if it travels at this velocity for 3s?

3. An object moves from a position of d = 2.0m to a position of d = -5.0m in 5.0s:
   a. Calculate the velocity of the object.
   b. Can you conclude that this is the objects average velocity over these 5.0s?
   c. Can you conclude that this velocity is uniform?

4. A professional hockey player shoots a 150km/h slapshot as they cross the blue line.
   a. What is the speed of the shot in m/s?
   b. If the goalie is 15m away, find the time it would take the puck to reach the goalie. What have you assumed in answering this question?

5. A Porsche starts out 75km [West] of Regina on the Trans-Canada highway. 1 hour and 10 minutes later it is 50km [East] of Regina. Assuming a uniform velocity, find the position of the Porsche, relative to Regina, 2 hours after it started its journey.

6. A research submersible descends toward the ocean floor at 0.50km/h. If the submersible starts out 2.0km above the ocean floor, find its elevation after 10.0 minutes.

7. A model rocket is launched straight up and falls straight back to the place it was launched. Its maximum altitude is 500m and its total time in the air is 10s. Find:
   a. its average velocity.
   b. its average speed.

Grade 11 Physics – Uniform Acceleration

Acceleration, $\vec{a}$, is how fast velocity is changing. This means that if an object's velocity is increasing *or* decreasing, there is acceleration. Acceleration can be calculated by the following formula, and the units are in m/s^2.

$$\vec{a} = \frac{\Delta\vec{v}}{\Delta t} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$$

Positive and Negative Acceleration:

In Physics, positives and negatives only indicate direction. A negative acceleration does not necessarily mean an object is slowing down, it means that the acceleration is in the negative direction. If the acceleration and the velocity are in the same direction, an object will speed up, if they are in opposite directions, it will slow down.

Example: A car is coasting backwards downhill at a speed of 3.0m/s when the driver gets the engine started. After 2.5s, the car is moving uphill at 4.5m/s. What is the car's acceleration?

Example: A car slows from 22m/s [East] to 3.0m/s [East] at a constant rate of $2.1 m/s^2$. How many seconds are required before the car is traveling at 3.0m/s?

Grade 11 Physics – Uniform Acceleration

1. A cart on a level surface starts with a velocity of 2.8 m/s [East]. It slows down at the rate of $0.25 m/s^2$. What time interval will it take for the cart to stop?

2. If the maximum emergency acceleration of a car is $8.0 m/s^2$ on a dry asphalt surface, how long would it take a car, traveling at 140 km/h [South] to stop after application of its brakes?

3. The family car accelerates at a rate of $1.6 m/s^2$ [East] for 5.0 s. What is the change in velocity of the car?

4. On re-entry to the Earth's atmosphere a spacecraft reduces its speed from 8000.0m/s [down] to 500.0m/s [down] in 400.0 s. What acceleration did the spacecraft undergo?

5. A car accelerates at a rate of 6.0 m/s^2 [East] on wet pavement. How long will it take the car to come to a complete stop if it was originally traveling at 120 km/h [West]?

6. A cart on a sloping track decreases in velocity from 2.2 m/s [East] to 0.60 m/s [East] in 1.4s. What is the acceleration of the cart?

7. A car traveling at 20.0 m/s [South] accelerates at 1.6 m/s^2 [South] for 8.0 s. For this time interval what will be the final velocity?

Uniform Acceleration Assignment

Prepare for Kinetics Quiz

Grade 11 Physics – Other Kinematics Equations

There are several other kinematics equations that are very useful when solving problems. These new equations can be used along with the other equations we know. Remember, average velocity, $\vec{v}_{avg}$, is different than change in velocity, $\Delta\vec{v}$.

Equation #1

This equation is just another way of calculating an average velocity. Think about calculating an average number, this formula works the same way.

Equation #2

To find this equation, we take Equation #1 and combine it with $\vec{v}_{avg} = \frac{\Delta\vec{d}}{\Delta t}$

Example: An object has an average velocity of 13m/s [North] and an initial velocity of 2.0m/s [North]. What is the final velocity of the object?

Example: A ball has an initial velocity of 3.0m/s [East]. It travels 4.0m [East] while accelerating to 11m/s [East]. How long does this take?

Do Other Kinematics Equations Assignment

Quiz

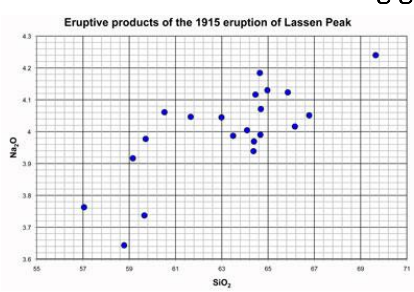
Grade 11 Physics – Kinematics Test Review

Answer the questions below. Make sure you round answers to the correct significant figures and have the right units and directions in your answers (when necessary)…watch for vectors!

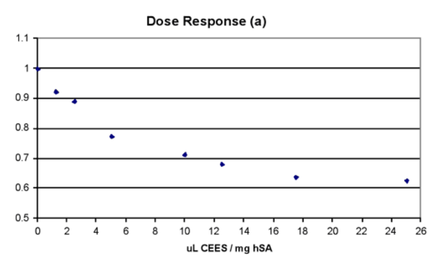
Physics Skills

1. Calculate the following:
   a. $(5.23 \times 10^{-5})(7.22 \times 10^{12})$
   b. $(7.56 \times 10^{16}) \div (9.44 \times 10^{-13})$
2. Convert the following:
   a. 7.34m/s to km/h.
   b. 88km/h to m/s.
   c. 3.56m/s to km/min.
3. Change the following using prefixes:
   a. 0.0000000021 g = ________________ ng
   b. 72300 m = ________________ hm
   c. 94000 kL = ________________ ML
   d. 8.2×10^{-8} m = ________________ µm

4. Draw the line of best fit for the following graphs:
   a.

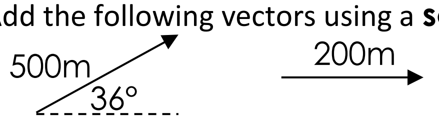


   b.

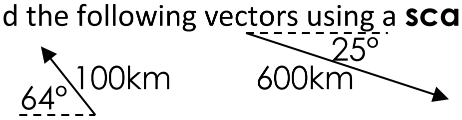


Vector Addition

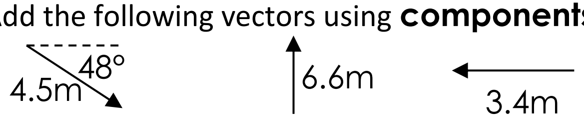
5. Use vector addition to add: 4.5m [North], 3.2m [South] and 1.1m [North]
6. Add the following vectors using a **scale diagram**: (no sig figs here)



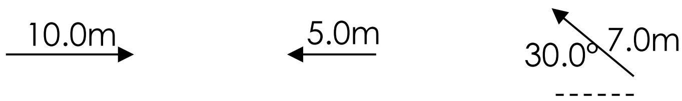
7. Add the following vectors using a **scale diagram**: (no sig figs here)



8. Add the following vectors using **components**:



9. Add the following vectors using **components**:



Distance/Displacement and Speed/Velocity

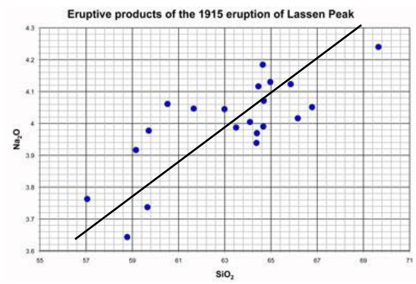
10. Robert travels 20.0m [South], then 30.0m [West]. What is his:
    a. Displacement?
    b. Distance?
    c. Average speed if the entire trip took 15.0s?
    d. Average velocity if the entire trip took 15.0s?
11. A car starts at their home. They drive 13km [East] and then turn around and drive 29km [West] (they realized they were driving the wrong direction).
    a. What was their distance?
    b. What was their displacement?
12. A person goes out for a walk one day. They walk 225m [North] in 11.0 minutes, and then turn around and walk 205m [South] in 481seconds.
    a. What was their average speed?
    b. What was their average velocity?

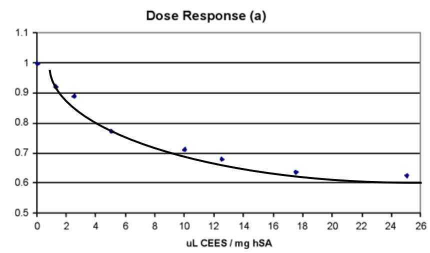
Kinematics Problems

13. An object went 480.0 m [West] in 6.00s.
    a. What is its average velocity?
    b. How long would it take to go 800.0 m?
    c. What would be its displacement if it went at this velocity for 8.00s?
14. A car accelerated from 5.0 m/s [South] to 25 m/s [South] in 10.0s.
    a. What was its average velocity?
    b. What was its displacement?
    c. What was its acceleration?
15. You and your friend start jogging around a 2.00×10^3m running track at the same time. You run at a speed of 3.15m/s, while your friend runs at 3.36m/s. How long does your friend wait for you at the finish line?
16. From an initial velocity of 20.0 m/s [E] an object accelerated at 2.00 m/s^2 [W] for 5.00 s.
    a. What was its final velocity?
    b. What was the displacement during that time?
17. An object going 100 m/s [S] accelerated uniformly so that it went 1.0 km [S] in 5s.
    a. Find its final velocity.
    b. What was its acceleration?
18. A man on roller blades is moving at 30.0 km/h [North] when he runs into a tree. If he stops in 0.450 s, calculate the acceleration.
19. Luke drops a pile of roof shingles from the top of a roof. They hit the ground 1.32s later. What was their displacement?

20. An airplane travels at a constant speed of 900.0km/h.
    a. What distance has the airplane travelled after 2.0h in the air?
    b. How long does it take for the airplane to travel between City A and City B if the cities are 3240km apart?
    c. If a second plane leaves 1.0h after the first, and travels at 1200km/h, which flight will arrive at City B first?
21. Rex throws his mother's crystal vase vertically upwards with an initial velocity of 26.2m/s. What was its displacement to the top of its path?

Grade 11 Physics – Kinematics Test Review Answers

1. (a) 3.78×10^8 (b) 8.01×10^{28}
2. (a) 26.4km/h (b) 24m/s (c) 0.214km/min
3. (a) 2.1 ng (because 0.0000000021 g = 2.1×10^{-9} g)
   (b) 723 hm (because 72300 m = 723×10^2 m)
   (c) 94 ML (because 94000 kL = 94×10^6 L)
   (d) 0.082 µm (because 8.2×10^{-8} m = 0.082×10^{-6} m)
4. (a)


(b)


5. 2.4m [North]
6. 680m [27° NE]
7. 530m [17° SE]
8. 3.3m [83° NW]
9. 3.7m [73° NW]
10. (a) 36.1m [33.7° SW] (b) 50.0m (c) 3.33m/s
    (d) 2.41m/s [33.7° SW] (note: velocity is the same direction as displacement)
11. (a) 42km (b) 16km [West]
12. (a) 0.377m/s (b) 0.0175m/s [North]
13. (a) 80.0m/s [West] (b) 10.0s (c) 6.40×10^2m [West]
14. (a) 15m/s [South] (b) 150m [South] (c) 2.0m/s^2 [South]
15. 40.0s
16. (a) 10.0m/s [E](b) 75.0m [E]
17. (a) 300m/s [S] (b) 40m/s^2 [S]
18. 18.5m/s^2 [South]
19. First find the final velocity (remember, a = 9.8m/s^2 [down]), then displacement:
    8.54m [down]
20. (a)1800km (b) 3.6h (c) 2.7h
21. First find the time to the top (remember, a = 9.8m/s^2 [down] and at the top, v = 0) and then calculate displacement: 35.0m [up]