Welcome to Physics 1!
How to Succeed in this Class

• Come to Class!
• Read the Book/Outline the book BEFORE lecture
• Take notes during class & rewrite them after.
• Check out the power point lectures online.
• Try the Homework Problems before Discussion Section
• COME TO MY OFFICE HOUR!
• Join MESA & Use the Tutorial Center!
• Form study groups and make regular meeting dates!
• Use the Phys/Eng Library to study in!
• Use other textbooks for more solved problems.
• Make up practice exams and practice taking tests!
• PRACTICE! PRACTICE! PRACTICE!
• No NEGATIVE TALK! LOVE PHYSICS!
Booze and Pot make you Stupid!

• Heavy drinking affects the hippocampus of the brain, which is involved in memory and learning.

• The short-term effects of marijuana can include problems with memory and learning; distorted perception; difficulty in thinking and problem solving; loss of coordination; and increased heart rate.

• Both booze and pot effect brain function days after you drink or smoke!
SRJC Student Guide

...a successful student must dedicate 2-3 hours outside class for every hour in class. In other words, a student taking 12 units is spending 12 hours in class and 24-36 hours outside of class in order to succeed.

A full time student has a full-time job just being a student.

Schedule your time so you study/solve hw problems when you are at your mental best. Do everything else (work, shop, exercise, sleep, etc.) during your less productive times.

Learn how you Learn!
What IS Physics?
Physics is...

The science that deals with matter, energy, motion and force.

- Random House Dictionary
Objectives of Physics

- To find the limited number of fundamental laws that govern natural phenomena
- To use these laws to develop theories that can predict the results of future experiments
- Express the laws in the language of mathematics
- Physics explores the full spectrum of the cosmos from subatomic particles to clusters of galaxies, to the edge of space and time...
From Subatomic Particles....

...to atoms ....
to stuff on Earth....

5000 N

50 × 25 = 5000 × 0.25

75-N friction force
75-N applied force
...creating new technologies....
...and super power ....
exploring Earth, Moon, Sun and planets…
to the stars and beyond ...
to clusters of Galaxies far, far away in space and back in time...
to the beginning and end of space and time ....
Physics seeks a single theory of Everything. . . .

Bubble Universes

Superstrings

Theory of Everything (TOE)
Classical Mechanics!

Study of the motion of objects and mechanical systems that are large relative to atoms and move at speeds much slower than the speed of light.
Isaac Newton
(1642 -1727)

In *Principia* (1687 )

• Invented Calculus
• 3 Laws of Motion
• Universal Law of Gravity

The force of gravity is *Universal*: The same force that makes an apple fall to Earth, causes the moon to fall around the Earth and the planets to orbit the Sun.
Classical vs Modern

- Laws of Physics are deterministic.
- Space and time are absolute.
- Particles are *Localized* in Space and have mass and momentum.
- Waves are *non-localized* in space and do not have mass or momentum.
- **Superposition**: Two particles cannot occupy the same space at the same time! But Waves can! Waves add in space and show interference.

- Laws of Physics are statistical.
- Space and time are relative.
- The speed of light is absolute.
- Particles are wave-like
- Waves are particle-like
Modern Physics: Quantum Physics & Relativity

- c circular orbit
- e elliptical orbit
- u unbound orbit

Diagram 1:
- Hyperspace
- Earth
- Vega
- Wormhole
- 25 light-years

Diagram 2:
- Measurement of Correlations between Components of Nuclear Spin

Diagram 3:
- Classical Bit
  - 0
  - 1

- Qubit
  - $|0\rangle$
  - $|1\rangle$
  - $|0\rangle + |1\rangle$

Diagram 4:
- Quantum Processor
- Binary States
- 000 001 010 011 100 101 110 111
SI Quantities & Units

• In mechanics, three *basic quantities* are used
  – Length, Mass, Time

• Will also use *derived quantities*
  – Ex: Joule, Newton, etc.

• SI – Système International
  – agreed to in 1960 by an international committee
Density: A derived Quantity

\[ \rho \equiv \frac{m}{V} \]

- Density is an example of a derived quantity
- It is defined as mass per unit volume
- Units are kg/m³
The meter is defined to be the distance light travels through a vacuum in exactly $\frac{1}{299792458}$ seconds. 1 m is about 39.37 inches.

I inch is about 2.54 cm.
Mass: Kilogram

• Units
  – SI – kilogram, kg

• Defined in terms of a kilogram, based on a specific cylinder kept at the International Bureau of Standards

• Mass is Energy!
  (Physcis 43)
Time: Second

- Units
  - seconds, s

- Defined in terms of the oscillation of radiation from a cesium atom

One second is the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium 133 atom.
Prefixes

- The prefixes can be used with any base units
- They are multipliers of the base unit
- Examples:
  - 1 mm = 10^{-3} m
  - 1 mg = 10^{-3} g

<table>
<thead>
<tr>
<th>Power</th>
<th>Prefix</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10^{-24}</td>
<td>yocto</td>
<td>y</td>
</tr>
<tr>
<td>10^{-21}</td>
<td>zepto</td>
<td>z</td>
</tr>
<tr>
<td>10^{-18}</td>
<td>atto</td>
<td>a</td>
</tr>
<tr>
<td>10^{-15}</td>
<td>femto</td>
<td>f</td>
</tr>
<tr>
<td>10^{-12}</td>
<td>pico</td>
<td>p</td>
</tr>
<tr>
<td>10^{-9}</td>
<td>nano</td>
<td>n</td>
</tr>
<tr>
<td>10^{-6}</td>
<td>micro</td>
<td>μ</td>
</tr>
<tr>
<td>10^{-3}</td>
<td>milli</td>
<td>m</td>
</tr>
<tr>
<td>10^{-2}</td>
<td>centi</td>
<td>c</td>
</tr>
<tr>
<td>10^{-1}</td>
<td>deci</td>
<td>d</td>
</tr>
<tr>
<td>10^{3}</td>
<td>kilo</td>
<td>k</td>
</tr>
<tr>
<td>10^{6}</td>
<td>mega</td>
<td>M</td>
</tr>
<tr>
<td>10^{9}</td>
<td>giga</td>
<td>G</td>
</tr>
<tr>
<td>10^{12}</td>
<td>tera</td>
<td>T</td>
</tr>
<tr>
<td>10^{15}</td>
<td>peta</td>
<td>P</td>
</tr>
<tr>
<td>10^{18}</td>
<td>exa</td>
<td>E</td>
</tr>
<tr>
<td>10^{21}</td>
<td>zetta</td>
<td>Z</td>
</tr>
<tr>
<td>10^{24}</td>
<td>yotta</td>
<td>Y</td>
</tr>
</tbody>
</table>
Powers of Ten!

How we see different-sized objects:

Approximate Values of Some Measured Lengths

<table>
<thead>
<tr>
<th>Description</th>
<th>Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance from the Earth to the most remote known quasar</td>
<td>$1.4 \times 10^{26}$</td>
</tr>
<tr>
<td>Distance from the Earth to the most remote normal galaxies</td>
<td>$9 \times 10^{25}$</td>
</tr>
<tr>
<td>Distance from the Earth to the nearest large galaxy</td>
<td>$2 \times 10^{22}$</td>
</tr>
<tr>
<td>(M 31, the Andromeda galaxy)</td>
<td></td>
</tr>
<tr>
<td>Distance from the Sun to the nearest star (Proxima Centauri)</td>
<td>$4 \times 10^{16}$</td>
</tr>
<tr>
<td>One lightyear</td>
<td>$9.46 \times 10^{15}$</td>
</tr>
<tr>
<td>Mean orbit radius of the Earth about the Sun</td>
<td>$1.50 \times 10^{11}$</td>
</tr>
<tr>
<td>Mean distance from the Earth to the Moon</td>
<td>$3.84 \times 10^{8}$</td>
</tr>
<tr>
<td>Distance from the equator to the North Pole</td>
<td>$1.00 \times 10^{7}$</td>
</tr>
<tr>
<td>Mean radius of the Earth</td>
<td>$6.37 \times 10^{6}$</td>
</tr>
<tr>
<td>Typical altitude (above the surface) of a satellite orbiting the Earth</td>
<td>$2 \times 10^{5}$</td>
</tr>
<tr>
<td>Length of a football field</td>
<td>$9.1 \times 10^{1}$</td>
</tr>
<tr>
<td>Length of a housefly</td>
<td>$5 \times 10^{-3}$</td>
</tr>
<tr>
<td>Size of smallest dust particles</td>
<td>$\sim 10^{-4}$</td>
</tr>
<tr>
<td>Size of cells of most living organisms</td>
<td>$\sim 10^{-5}$</td>
</tr>
<tr>
<td>Diameter of a hydrogen atom</td>
<td>$\sim 10^{-10}$</td>
</tr>
<tr>
<td>Diameter of an atomic nucleus</td>
<td>$\sim 10^{-14}$</td>
</tr>
<tr>
<td>Diameter of a proton</td>
<td>$\sim 10^{-15}$</td>
</tr>
</tbody>
</table>

© 2004 Thomson/Brooks Cole

https://www.youtube.com/watch?v=bhofN1xX6u0
Commonly used metric system units and symbols

<table>
<thead>
<tr>
<th>Quantity measured</th>
<th>Unit</th>
<th>Symbol</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length, width,</td>
<td>millimeter</td>
<td>mm</td>
<td>10 mm = 1 cm</td>
</tr>
<tr>
<td>distance, thickness,</td>
<td>centimeter</td>
<td>cm</td>
<td>100 cm = 1 m</td>
</tr>
<tr>
<td>girth, etc.</td>
<td>meter</td>
<td>m</td>
<td></td>
</tr>
<tr>
<td></td>
<td>kilometer</td>
<td>km</td>
<td>1 km = 1000 m</td>
</tr>
<tr>
<td>Mass</td>
<td>milligram</td>
<td>mg</td>
<td>1000 mg = 1 g</td>
</tr>
<tr>
<td>(“weight”)*</td>
<td>gram</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td></td>
<td>kilogram</td>
<td>kg</td>
<td>1 kg = 1000 g</td>
</tr>
<tr>
<td></td>
<td>metric ton</td>
<td>t</td>
<td>1 t = 1000 kg</td>
</tr>
<tr>
<td>Time</td>
<td>second</td>
<td>s</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>degree Celsius</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>

Commonly used metric prefixes

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Symbol</th>
<th>Factor</th>
<th>Numerically</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>giga</td>
<td>G</td>
<td>$10^9$</td>
<td>1 000 000 000</td>
<td>billion**</td>
</tr>
<tr>
<td>mega</td>
<td>M</td>
<td>$10^6$</td>
<td>1 000 000</td>
<td>million</td>
</tr>
<tr>
<td>kilo</td>
<td>k</td>
<td>$10^3$</td>
<td>1 000</td>
<td>thousand</td>
</tr>
<tr>
<td>centi</td>
<td>c</td>
<td>$10^{-2}$</td>
<td>0.01</td>
<td>hundredth</td>
</tr>
<tr>
<td>milli</td>
<td>m</td>
<td>$10^{-3}$</td>
<td>0.001</td>
<td>thousandth</td>
</tr>
<tr>
<td>micro</td>
<td>μ</td>
<td>$10^{-6}$</td>
<td>0.000 001</td>
<td>millionth</td>
</tr>
<tr>
<td>nano</td>
<td>n</td>
<td>$10^{-9}$</td>
<td>0.000 000 001</td>
<td>billionth**</td>
</tr>
</tbody>
</table>
To convert from one unit to another, multiply by conversion factors that are equal to one.

Example: \(32 \text{ km} = ? \text{ nm}\)

1. \(1 \text{ km} = 10^3 \text{ m}\)
2. \(1 \text{ nm} = 10^{-9} \text{ m}\)

\[
32 \text{ km} \left( \frac{10^3 \text{ m}}{1 \text{ km}} \right) \left( \frac{10^9 \text{ nm}}{1 \text{ m}} \right) = 32 \times 10^3 \times 10^9 \text{ nm} = 3.2 \times 10^{13} \text{ nm}
\]
1 light year = 9.46 x 10^{15} \text{m}
1 \text{ mile} = 1.6 \text{ km}

How many miles in a light year?

\[
\frac{1\text{ly}}{1\text{ly}} \left( \frac{9.46 \times 10^{15} \text{m}}{1\text{ly}} \right) \left( \frac{1\text{mile}}{1.6 \times 10^3 \text{m}} \right) = 5.9 \times 10^{12} \text{ miles}
\]
1 light year = $9.46 \times 10^{15}$ m
1 mile = 1.6 km

~ 6 Trillion Miles!!

Closest Star: Proxima Centauri 4.3 ly
Closest Galaxy: Andromeda Galaxy 2.2 million ly
It had long been known that Andromeda is rushing towards Earth at about 250,000 miles per hour -- or about the distance from Earth to the moon. They will collide in 4 billion years!
### Sense of Scale

<table>
<thead>
<tr>
<th>Table 1.5 Approximate conversion factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cm ≈ $\frac{1}{2}$ in</td>
</tr>
<tr>
<td>10 cm ≈ 4 in</td>
</tr>
<tr>
<td>1 m ≈ 1 yard</td>
</tr>
<tr>
<td>1 m ≈ 3 feet</td>
</tr>
<tr>
<td>1 km ≈ 0.6 mile</td>
</tr>
<tr>
<td>1 m/s ≈ 2 mph</td>
</tr>
</tbody>
</table>
18. Use Tables 1.4 and 1.5 and Examples 1.2 and 1.3 to assess whether or not the following statements are reasonable.

a. Joe is 180 cm tall.

b. I rode my bike to campus at a speed of 50 m/s.

c. A skier reaches the bottom of the hill going 25 m/s.

d. I can throw a ball a distance of 2 km.

---

**Table 1.5** Approximate conversion factors

<table>
<thead>
<tr>
<th>Conversion</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cm</td>
<td>( \frac{1}{2} ) in</td>
</tr>
<tr>
<td>10 cm</td>
<td>4 in</td>
</tr>
<tr>
<td>1 m</td>
<td>1 yard</td>
</tr>
<tr>
<td>1 m</td>
<td>3 feet</td>
</tr>
<tr>
<td>1 km</td>
<td>0.6 mile</td>
</tr>
<tr>
<td>1 m/s</td>
<td>2 mph</td>
</tr>
</tbody>
</table>

---

**Table 1.6** Some approximate lengths

<table>
<thead>
<tr>
<th>Description</th>
<th>Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circumference of the earth</td>
<td>( 4 \times 10^7 )</td>
</tr>
<tr>
<td>New York to Los Angeles</td>
<td>( 5 \times 10^6 )</td>
</tr>
<tr>
<td>Distance you can drive in 1 hour</td>
<td>( 1 \times 10^5 )</td>
</tr>
<tr>
<td>Altitude of jet planes</td>
<td>( 1 \times 10^4 )</td>
</tr>
<tr>
<td>Distance across a college campus</td>
<td>1000</td>
</tr>
<tr>
<td>Length of a football field</td>
<td>100</td>
</tr>
<tr>
<td>Length of a classroom</td>
<td>10</td>
</tr>
<tr>
<td>Length of your arm</td>
<td>1</td>
</tr>
<tr>
<td>Width of a textbook</td>
<td>0.1</td>
</tr>
</tbody>
</table>
Significant Figures

• A significant figure is one that is reliably known

• Zeros may or may not be significant
  – Those used to position the decimal point are not significant
  – To remove ambiguity, use scientific notation

• In a measurement, the significant figures include the first estimated digit
Significant Figures, examples

• 0.0075 m has 2 significant figures
  – The leading zeros are placeholders only
  – Can write in scientific notation to show more clearly:
    \(7.5 \times 10^{-3}\) m for 2 significant figures

• 10.0 m has 3 significant figures
  – The decimal point gives information about the reliability of the measurement

• 1500 m is ambiguous
  – Use \(1.5 \times 10^3\) m for 2 significant figures
  – Use \(1.50 \times 10^3\) m for 3 significant figures
  – Use \(1.500 \times 10^3\) m for 4 significant figures
Sig Figs & Scientific Notation

Leading zeros locate the decimal point. They are not significant.

\[ 0.00620 = 6.20 \times 10^{-3} \]

A trailing zero is reliably known. It is significant.

The number of significant figures is the number of digits when written in scientific notation.

- The number of significant figures ≠ the number of decimal places.
- Changing units shifts the decimal point but does not change the number of significant figures.
1.4 A Sense of Scale: Significant Figures, Scientific Notation, and Units

14. How many significant figures does each of the following numbers have?
   a. 6.21   
   b. 62.1   
   c. 6210   
   d. 6210.0
   e. 0.0621 
   f. 0.620  
   g. 0.62   
   h. .62   
   i. 1.0621
   j. $6.21 \times 10^3$
   k. $6.21 \times 10^{-3}$
   l. $6.21 \times 10^3$

15. Compute the following numbers, applying the significant figure standards adopted for this text.
   a. $33.3 \times 25.4 =$
   b. $33.3 - 25.4 =$
   c. $33.3 + 45.1 =$
   d. $33.3 \times 45.1 =$
   e. $2.345 \times 3.321 =$
   f. $(4.32 \times 1.23) - 5.1 =$
   g. $33.3^2 =$
   h. $\sqrt{33.3} =$

16. Express the following numbers and computed results in scientific notation, paying attention to significant figures.
   a. $9,827 =$
   b. $0.000000550 =$
   c. $3,200,000 =$
   d. $32,014 \times 47 =$
   e. $0.059 \div 2,304 =$
   f. $320. \times 0.050 =$
Rounding

- Last retained digit is increased by 1 if the last digit dropped is 5 or above
- Last retained digit remains as it is if the last digit dropped is less than 5
- If the last digit dropped is equal to 5, the retained digit should be rounded to the nearest even number
- Saving rounding until the final result will help eliminate accumulation of errors
- Keep a few extra terms for intermediate calculations
Round Each to 3 Sig Figs

• 124.65
• 0.003255
• 12.25
• 3675
17. Convert the following to SI units. Work across the line and show all steps in the conversion. Use scientific notation and apply the proper use of significant figures. **Note:** Think carefully about g and h. Pictures may help.

a. \(9.12 \, \mu s \times\)

b. \(3.42 \, \text{km} \times\)

c. \(44 \, \text{cm/ms} \times\)

d. \(80 \, \text{km/hr} \times\)

e. \(60 \, \text{mph} \times\)

f. \(8 \, \text{in} \times\)

g. \(14 \, \text{in}^2 \times\)

h. \(250 \, \text{cm}^3 \times\)
Operations with Significant Figures – Multiplying or Dividing

• When multiplying or dividing, the number of significant figures in the final answer is the same as the number of significant figures in the quantity having the lowest number of significant figures.

• Example: 25.57 m x 2.45 m = 62.6465 m²
  – The 2.45 m limits your result to 3 significant figures: 62.6m²
Operations with Significant Figures – Adding or Subtracting

• When adding or subtracting, the number of decimal places in the result should equal the smallest number of decimal places in any term in the sum.

• Example: 135 cm + 3.25 cm = 138 cm
  – The 135 cm limits your answer to the units decimal value
1.4 A Sense of Scale: Significant Figures, Scientific Notation, and Units

14. How many significant figures does each of the following numbers have?

a. 6.21  
   b. 62.1  
   c. 6210  
   d. 6210.0
   e. 0.0621  
   f. 0.620  
   g. 0.62  
   h. .62
   i. 1.0621
   j. 6.21 \times 10^3
   k. 6.21 \times 10^{-3}
   l. 62.1 \times 10^3

15. Compute the following numbers, applying the significant figure standards adopted for this text.

a. \(33.3 \times 25.4 = \)
   b. \(33.3 - 25.4 = \)
   c. \(33.3 \div 45.1 = \)
   d. \(33.3 \times 45.1 = \)
   e. \(2.345 \times 3.321 = \)
   f. \((4.32 \times 1.23) - 5.1 = \)
   g. \(33.3^2 = \)
   h. \(\sqrt{33.3} = \)

16. Express the following numbers and computed results in scientific notation, paying attention to significant figures.

a. \(9,827 = \)
   b. \(0.0000000550 = \)
   c. \(3,200,000 = \)
   d. \(32,014 \times 47 = \)
   e. \(0.059 \div 2,304 = \)
   f. \(320. \times 0.050 = \)
Operations With Significant Figures – Summary

• The rule for addition and subtraction are different than the rule for multiplication and division

• For adding and subtracting, the number of decimal places is the important consideration

• For multiplying and dividing, the number of significant figures is the important consideration
A rectangular plate has a length of 21.3 cm and a width of 9.8 cm. Calculate the area of the plate, and the number of significant figures.

\[ A = 21.3\text{cm} \times 9.8\text{cm} = 208.74\text{cm}^2 \]

How many significant figures? 2

\[ A = 210\text{cm}^2 \]
Trigonometry

$h = \text{hypotenuse}$

$h_o = \text{length of side opposite the angle } \theta$

$h_a = \text{length of side adjacent to the angle } \theta$
Trigonometry

\[
\sin \theta = \frac{\text{opp}}{\text{hyp}} = \frac{h_o}{h}
\]

\[
\cos \theta = \frac{\text{adj}}{\text{hyp}} = \frac{h_a}{h}
\]

\[
\tan \theta = \frac{\text{opp}}{\text{adj}} = \frac{h_o}{h_a}
\]

\[
h^2 = h_a^2 + h_o^2
\]

\[
\theta = \tan^{-1}\left(\frac{h_o}{h_a}\right)
\]

- \(h = \text{hypotenuse}\)
- \(h_o = \text{length of side opposite the angle } \theta\)
- \(h_a = \text{length of side adjacent to the angle } \theta\)
Trigonometry

\[
\sin \theta = \frac{h_o}{h} \quad \cos \theta = \frac{h_a}{h} \quad \tan \theta = \frac{h_o}{h_a}
\]

\[
h^2 = h_a^2 + h_o^2
\]

\[
\theta = \tan^{-1}\left(\frac{h_o}{h_a}\right)
\]

- \(h = \text{hypotenuse}\)
- \(h_o = \text{length of side opposite the angle } \theta\)
- \(h_a = \text{length of side adjacent to the angle } \theta\)
**Trigonometry**

\[
\sin \theta = \frac{h_o}{h} \quad \rightarrow \quad h_o = h \sin \theta
\]

\[
\cos \theta = \frac{h_a}{h} \quad \rightarrow \quad h_a = h \cos \theta
\]

\[
\tan \theta = \frac{h_o}{h_a} \quad \rightarrow \quad h_o = h_a \tan \theta
\]
Inverse Functions

\[\sin \theta = \frac{h_o}{h} \quad \rightarrow \quad \theta = \sin^{-1}\left(\frac{h_o}{h}\right)\]

\[\cos \theta = \frac{h_a}{h} \quad \rightarrow \quad \theta = \cos^{-1}\left(\frac{h_a}{h}\right)\]

\[\tan \theta = \frac{h_o}{h_a} \quad \rightarrow \quad \theta = \tan^{-1}\left(\frac{h_o}{h_a}\right)\]
Problem

What is the height of the building?

Known: $\theta = 50.0$ degrees, $h_a = 62.7$ m

Unknown: $h_o = ?$

$$h_o = h_a \tan \theta$$
What is the height of the building?

Known: $\theta = 50.0$ degrees, $h_a = 62.7$ m
Unknown: $h_o = ?$

\[
h_o = h_a \tan \theta
\]

\[
= (67.2m) \tan 50.0^\circ
\]

\[
= (67.2m)(1.19)
\]

\[
= 80.1m
\]
θ = 30°

h = 2.50 m

\[ x = h \cos \theta \]

\[ y = h \sin \theta \]
Find $x$ and $y$.

\[ \sin \theta = \frac{opp}{hyp} = \frac{y}{h} \]

\[ y = h \sin \theta \]
\[ = 2.5m \sin 30^\circ \]
\[ = 1.25m \]
Find x and y.

\[ \cos \theta = \frac{adj}{hyp} = \frac{x}{h} \]

\[ x = h \cos \theta \]

\[ = 2.5m \cos 30^\circ \]

\[ = 2.17m \]

\[ y = 1.25m \]

\[ x = 2.17m \]
A boat travels a distance of 2 km at an angle 25 degrees North of East, as shown. How far did it travel East and North? (Find x and y.)
Finding the Angle

Find the total velocity just before hitting the ground (magnitude and direction)
Similar Triangles
If sides are parallel, angles are the same.
Similar Triangles
If sides are mutually perpendicular, angles are the same.
If the skier has a weight of 800N, what are the components parallel and perpendicular to the incline?