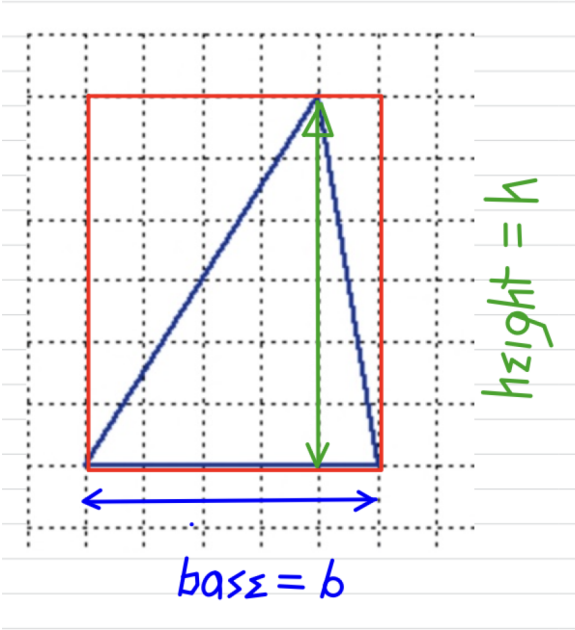
Problem Set 0 = Chapter 1 = Measurements

4. Area of a rectangle

5. Triangle on a square grid (A)

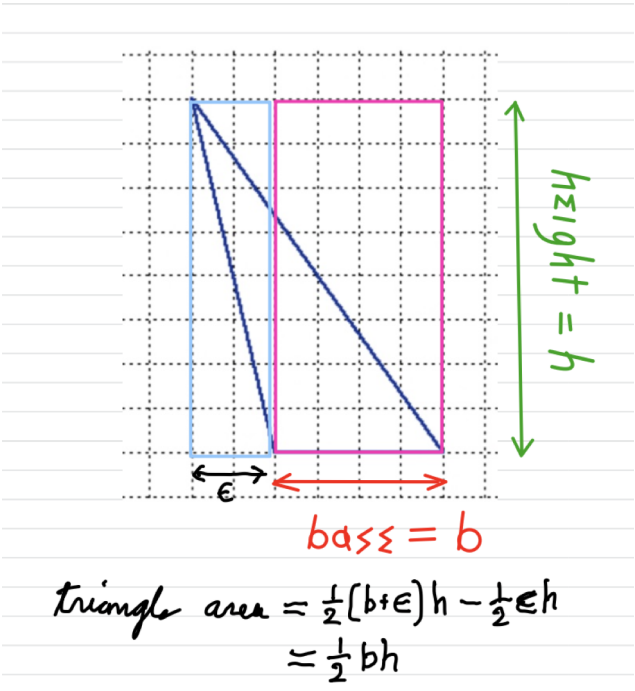
Note that the vertices are on grid points.
Use that to determine the various distances in kilometer units (km).



Area of the rectangle = base x height = b h.
Area of the triangle is half as much = $\frac{1}{2}$ b h. [Do you see why?]

6. Triangle on a square grid (B)

Note that the vertices are on grid points.
Use that to determine the various distances in centimeter units (cm).



Area of the pink rectangle = base x height = b h.
Area of the blue triangle is half as much = $\frac{1}{2}$ b h. [Do you see why?]

7. Triangle on a square grid (C)

Note that the vertices are on grid points.
Use that to determine the various distances in given units.

Area of the rectangle = base x height = b h.
Area of the triangle is half as much = $\frac{1}{2}$ b h. [Do you see why?]

5. Trapezoid on a square grid

Note that some points are on grid points.
Use that to determine the various distances in meter units (m).

The trapezoid is a rectangle plus a triangle.

6. Circle on a square grid

Note that some points on the circle are on grid points.
Use that to determine the dimensions of an inscribed rectangle, in meter units (m).

Calculate the diameter d by the Pythagorean Theorem.

The area of a circle is πr^2 where r is the radius = d /2.

7. Adding vectors

All vectors can be resolved into x-components and y-components.

For example, $\vec{A} = a_x \hat{i} + a_y \hat{j}$.

Use the coordinate system to determine the component values.

Adding vectors: $\vec{M} = \vec{A} + \vec{B} = m_x \hat{i} + m_y \hat{j}$;

$m_x = a_x + b_x$ and $m_x = a_x + b_x$

The length of $\vec{M} = |\vec{M}| = \sqrt{m_x^2 + m_y^2}$ by the Pythagorean Theorem.

8. Rope tied around the Earth

The circumference of a circle is 2π r , where r is the radius.
The initial length of the rope = circumference of the Earth = $2\ \pi R_E$ = 40 x 10^6 miles.

TAKE NOTES

Chapter 1
Measurements in Physics

PAGE 1

TO LEARN

SI units

length distance time
kg m s

SI prefixes

$1\ kg = 10^3\ g$ $\quad 10^6\ m = 10^3\ km = 1\ Mm$

$1\ g = 10^{-3}\ kg$ $\quad 10^{-6}\ s = 1\ \mu s$

Converting units

$1\ mile = 1609\ m$

$1\ hr = 3600\ s$

$60\ mph = 60 \times \frac{1609\ m}{3600\ s} = 26.8\ \frac{m}{s}$

Dimensional analysis

$speed = \frac{distance}{time}$ $\quad [v] = \frac{[d]}{[t]} = \frac{m}{s}$

Sig Figs

1.00 is not the same as 1

In LONCAPA use appropriate Sig. figs.

$$6\overline{)160.9} \quad 26.8$$

Problem 1-63

Some Hints For Problem Set 0

Approximate planet Saturn as a sphere (neglect the rings) with mass M and radius R. (A) Calculate the mean density. (B) The density of water is 1000 kg/m^3. What is the ratio of Saturn to water?

The value of M in Appendix E is wrong.

LOOK UP M & R

DENSITY $\rho = \frac{M}{V}$ $V = \frac{4}{3}\pi R^3$

UNITS of ρ: $\frac{kg}{m^3}$

Problem 1-65

In 1973 the horse Secretariat ran 1.5 miles in 2 minutes and 24 seconds, in the Belmont Stakes. (A) Calculate his average speed, in SI units. (B) Calculate

$$v \simeq \frac{\Delta s}{\Delta t}$$

$s_{initial} = 0$, $s_{final} = 1.5$ mi

$\Delta s = 1.5$ mi

$\Delta t = 2 \times 60 + 24 = 144$ s

Don't touch your calculator until you have derived the equation.

DELTA NOTATION

ΔQ = a change of Q

$\Delta Q = Q_{FINAL} - Q_{INITIAL}$

UNITS

1 mi = 1609 m

m = meter

s = second

A PROBLEM FOR THE FLAT EARTH SOCIETY: WHO MEASURED THE RADIUS OF THE EARTH ? (COLUMBUS ?)

ERATOSTHENES of CYRENE (276-194 BC)

Problem 1-66

Hint: $S = R\theta$ w/ θ in radians

arclength = radius • angle