Unit 1

Measurement and Probability

Suggested Time: 16 Hours

In Mathematics 1202 and 2202, students explored the SI and imperial systems of measurement. They used various measuring devices to calculate measurements in SI and imperial units. Students worked with units for length, area, volume, capacity, mass and temperature. They also worked with unit conversions within and between both systems (M1, M2). In this unit, the focus is on the precision and accuracy of measurements.

Terminology (Must go in Your Notes!)

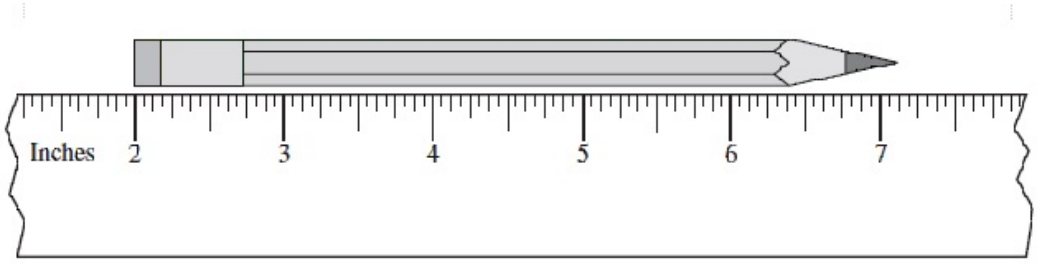
Accuracy: the degree to which a measurement is measured and reported correctly

Ex) The length of your desk is:

A) 20 inches
B) 23.5 inches
C) 2.5 feet
D) 3 feet
E) 50 cm
F) 57 cm
G) 59.6 cm

http://www.youtube.com/watch?v=lZ3Ec1p93PA

Ex) Which measure is the most accurate?



A. $5\frac{1}{8}\ in$
B. $5.2\ in$
C. $5\frac{1}{4}\ in$
D. $7\frac{1}{8}\ in$

(Assumptions about accuracy) Sept 6, 2013

When using a measuring cup (any measuring device)

A) The manufacturer made sure the object actually measures that amount

B) Same measurements can be obtained regardless who uses it

C) Accuracy depends on on how careful it is used

Precision : the degree of exactness to which a measurement is expressed...depends on the scale used...remember the more fineness (ticks etc.) the more precision

DON'T WRITE Ex) Which rulers have the least, most, precision

Ex) Explain using the examples the difference between precision and accuracy:

A) A contractor develops a material list to provide reasonable estimates for jobs (Accuracy)
B) A seamstress hems a pair of pants (Precision-fine measurements)
C) A house painter determines how much paint is needed (accuracy)

Discuss (Don't Write)

- A person being treated for diabetes requires 2.5 units of insulin to account for the number of carbohydrates. He draws up 2.8 units of insulin to take. accuracy off precision good (1 decimal place)
- A carpenter cuts a piece of crown moulding that is required to be 22.5°. Due to the tool being used, she can only cut to the nearest degree. When completed, the angle is noted to be 22°.

both are off why?

Ex) Vic and his daughter Angela are pouring a concrete pad that measure 20 ft. x 16 ft. x 3 in. For their garage. (V = LxWxH)

Vic says we need 960 cubic feet
Angela says we need 80 ft.^{3}

A) Who is more accurate?

Vic: Vol = 20 x 16 x 3 = ??? ft^3

Angela: Vol = 20 x 16 x $\frac{1}{4}$ = ???ft^3 why $\frac{1}{4}$?

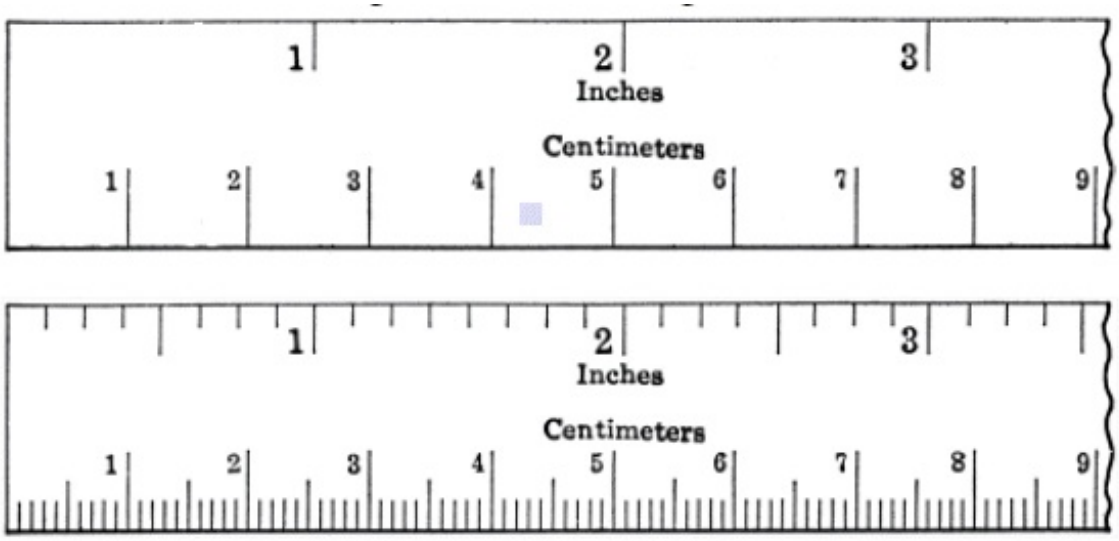
3 in. = 3 in. x $\frac{1\ ft.}{12\ in.} = \frac{3}{12} = \frac{1}{4}$?

Angela is more accurate since all her measurements were converted into Feet.

B) Don't write. Why is it important to be accurate?

Dealing with Precision

There is a degree of un-certainity when measuring due to limitations of measuring devices. Consider:



Measure:

<==========>

Ruler 1 inches = 3

Ruler 1 cm = 7

Ruler 2 inches=$2\frac{7}{8}$

Ruler 2 cm = 7.4 cm Or 7cm 4 mm

Which ruler is more precise? Why?

Leads to a greater degree of **uncertainity** when devices have less precision.

The top ruler can measure to the nearest cm with CERTAINITY while the bottom ruler can measure to the nearest 0ne-tenth ($\frac{1}{10}$) with certainity.

Marin of error: take the unit of measurement and divide by 2

IE Ruler 1 MOE (Margin Of Error)= .5 cm this means any measure read in the range of .5 cm below or .5 cm above the actually measurement is acceptable. The range of tolerance is ± .5 cm

For example a line is actually 8.5 cm long

8.5 cm -.5 cm =8 cm
8.5 cm +.5 cm = 9.0 cm

MOE RuLER 2 = in inches
= in cm

1.1 Continued

Tolerance: the amount a measurement is allowed to vary

Ex) The dimensions of a door has a tolerance of 2mm. If the door actually measures 81 mm, what are the acceptable range of measurements?

$81 \pm 2 =$

Ex) Nail manufacturers produce 2-inch nails with a tolerance of $\frac{1}{8}$ of an inch:

accepted measurements: $2 \pm \frac{1}{8}$

Ex) A dairy farmer prepares 15 mL of antibiotic in a syringe marked in 1-mL increments. The tolerance is ± 0.5 mL. What are the maximum and minimum allowable measurements?

Ex) What are the maximum and minimum measures allowable, based on the given tolerance.

(i) $1.2699'' \pm 0.0009''$
(ii) $2.000'' \pm 0.002''$
(iii) $10.203 \text{ mm} \pm 0.024 \text{ mm}$
(iv) $64.86 \text{ mm} \pm 0.03 \text{ mm}$

Probability and Odds 1.2

Probability: the likelihood an event is going to happen.
Comparison of outcomes in favor to total outcomes.

i) always between 0 and 1(inclusive)
ii) an event that is certain to occur is assigned 1 or 100%
iii) an event that is not going to occur is assigned a value of 0
iv) Can be expressed as fractions, decimals, percent

The probability tomorrow is Wed is _____.
" " " Fri is _____.

P(E) = the likelihood an event will happen

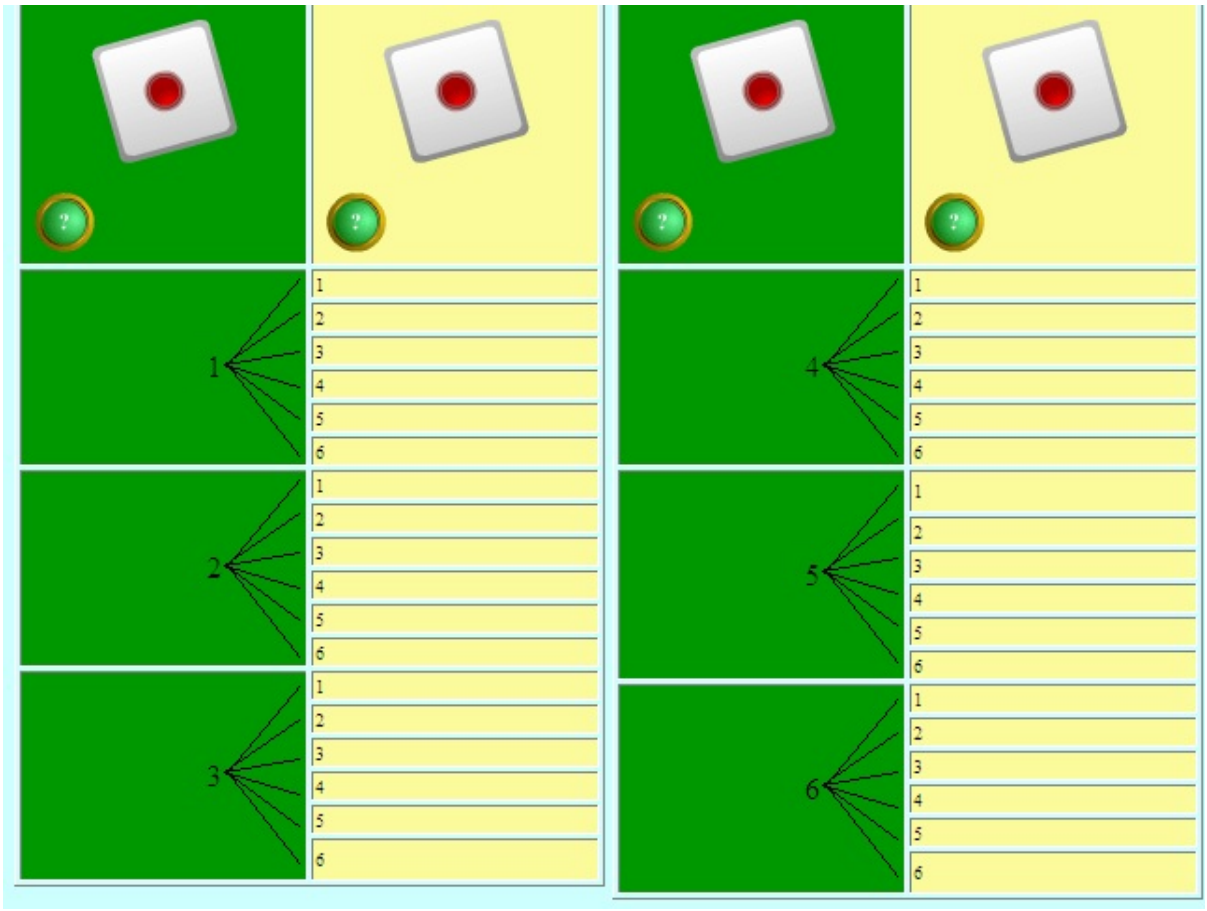
$$P(E) = \frac{outcome \text{ in } favour}{total\ outcomes}$$

Ex) Compute the following: (leave 2 lines between each)
A) the probability of rolling 2 on a di
must be

P(e) = $\frac{1}{6} = .1\overline{6} = 17\%$ note 3 ways

B) “ ” “ rolling a sum of 4 on two dice(tree diagram) Outcomes:(1,3) (2,2) (3,1)

P(sum of 4)= $\frac{3}{36} = \frac{1}{12}$



C) the rolling of the sum of 7 (tree diagram)

Outcomes: (1.6) (2,5) (3,4) (4,3) (5,2) (6,1)

P(rolling a sum of 7) = $\frac{6}{36}$

Ex) 8 red , 6 blue, and 10 black marbles are placed in a bag. Complete:

Total outcomes =8 + 6 + 10 = 24

P(E)	reduced fraction	decimal	percent	Words
P(selecting a red marble)	$\frac{8}{24}=\frac{1}{3}$	.33	33%	“1 in 3"
P(Black)	$\frac{10}{24}=\frac{5}{12}$	.42	42%	“5 in 12"
P(blue)	$\frac{6}{24}=\frac{1}{4}$	.25	25%	“1 in 4"
P(orange)	$\frac{0}{24}=0$	0	0%	“no

Odds Against

Odds Against: A ratio that compares the number of unwanted outcomes to the number of wanted outcomes.

Odds in Favor = unwanted outcomes : wanted outcomes

*opposite of Odds in Favor.

Ex. A gas station is running a promotion with a 1 in 7 chance of winning a prize with each purchase. If Kevin makes a purchase, what are the odds in favor and the odds against him winning? Are the odds in his favor.

Odds in Favor = wanted outcomes : unwanted outcomes
=1winner : 6 non-winners
=1:6

Odds Against = unwanted outcomes : wanted outcomes
=6 non-winners : 1 winner
=6:1

The odds are not in Kevins' favor. The odds are 6 to 1 against him winning.

What is the probability of Kevin winning?

$$P(W) = \frac{WantedOutcomes}{TotalOutcomes}$$

$$= \frac{1}{7} = 0.14 = 0.14(100\%) = 14\%$$

- Ask students to determine the probability of each event:

(i) Odds in favour of the event are 1:3.
(ii) Odds against the event are 5:1.
(iii) Odds in favour of the event are 50:1.
(iv) Odds against the event are 1:1.

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Theoretical & Experimental Probability 1.3

Theoretical probability: comparison of favorable outcomes to total number of outcomes based on **what should happen mathematically**

Experimental probability: comparison of favorable outcomes to total number of outcomes based on **experiment** (what actually happens!)

http://www.random.org/coins/?num=10&cur=60-cad.005c

http://shazam.econ.ubc.ca/flip/ (Individual Coin! You need this site for later!)

Ex) On the toss of a coin the theoretical probability of getting heads is ½. So if you tossed a coin 50 times you would expect it to turn up 25 times as heads. This is often not the case as the empirical probability is what actually happens. Heads may turn up 30

times in the experiment of tossing 50 coins.

Ex) You roll a dice 10 times. The number 6 turns up 3 times.

A) What is the theoretical probability of getting a six on a di? 1/6

B) What was the actual empirical probability for the experiment? 3/10