ASTR 105G: M01/M02

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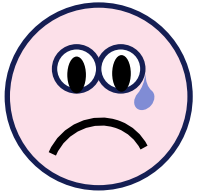
YOUR LAB BIBLE

Expectations

- Lab is *extremely* important! (25% of your grade)
- 2 parts: **in-class** (groups of 3 to 4 people, worth 65 points) + **Take-Home** (INDIVIDUALLY COMPLETED, worth 35 points) = **100 points per week**
- Since you will only turn in 1 lab report per group, it's expected that everyone will contribute equally. *Grades will depend on equal participation*.
- Read the manual *BEFORE* lab each week. You should already been doing this because of your Sunday Canvas quizzes!
- **Every person** should have a copy of the lab manual, and each group should turn in one copy of the answer sheet each week (chosen at random!).
- Please show up on time, and leave when your group is finished.



Plagiarism: Just Don't.

http://studenthandbook.nmsu.edu/student-code-of-conduct/academic-misconduct/

- Cite your source **AND** write in your own words (no copy/paste). Mixing around words to avoid exact matching of a sentence is also unacceptable.
- Don't put your name on work that isn't yours, work somebody else did for you, or work you've turned in previously, and don't write someone else's name.
- Etc., etc. This is not an exhaustive list…*****review the syllabus*****.
- 1st offense: zero on the assignment and notification of your professor
- 2nd offense: ***Dean will be contacted directly***

Important Points

- You may join another lab section if you know you will be absent, but please *tell me beforehand* so I can clear it with the other TA.
- Always show your work. This is essential to get partial credit.
- Write units where applicable. Don't lose points for no reason!
- Take the at-home questions seriously, but don't go overboard…all you need to do is answer each question in a few complete sentences (see examples on syllabus).
- **Have a question? Don't just sit there and be confused. Ask me!**

Lab Materials: Breakdown

The different lab components often overwhelm and confuse students in the beginning, so let's go over what you need *now*, slowly and step-by-step.

1. Your group's **ANSWER SHEET**, which will need to turn in for all subsequent labs (but not this one). You will turn in *only one* of these per group with every person's name *written in their own handwriting* at the top of the page.
2. Your own **LAB MANUAL**, which can be found on the Canvas homepage for this course. Everyone should bring their own digital or hard copy and **follow along**.
3. The **Take-Home Section**, which you will turn in by the following Sunday night @ 11:59pm (.pdf, .doc, or .docx only). **The prompts can be found at the end of the lab manuals**, and due dates should be on Canvas.

Next Week: Breakdown

- You should come to the next class (on time) having thoroughly read the online syllabus **and** the lab manual (Seasons) you are doing that day.
- You will meet with your groups that were assigned to you, which you will already know via an email I will send you (I recommend reaching out to one another as soon as possible to determine logistics!).
- You'll turn in your first "Take-Home Exercise" by the end of this lab.
- Each group should bring enough **digital or hard copies of the lab manual** for everyone to follow along with the lessons and questions.
- ***Every group member MUST bring an answer sheet.***

Lab #1: Mathematics Intro

- Unit Conversion
- Math Expressions
- Scientific Notation
- The Metric System
- Algebra
- Graphing

Units (*No Units = Dimensionless*)

- **1 meter (m) = 40 inches (in) → **#3 and beyond****
- 100 meter (m) = 111 yards (yd)
- 1 mile (mi) = 1.6 kilometers (km)
- **1 Astronomical Unit (AU)** = 149,600,000 kilometers (km)
- 1 light year (ly) = 9,460,000,000,000 kilometers (km)
- **1 parsec (pc)** = 3.26 light years (ly)
- 1 liter (L) = 1.101 quarts (qt)
- 1 kilogram (kg) = 2.2 pounds (lbs)

Unit Conversion: *Fractions Are Your Friend*

How many miles long is a 10K (10 kilometer race)?

$$10\ \cancel{\text{km}}\ \text{x}\ \frac{1\ \text{mi}}{1.6\ \cancel{\text{km}}} = 6.25\ \text{mi}$$

This is a **very** important concept to understand. You will use it in **every** lab, so if you don't understand, *speak now or forever hold your peace*!

Exponents

$$2^4 = 2 \times 2 \times 2 \times 2 = 16$$

$$\sqrt{16} = 16^{1/2} = 4 \qquad 16^{1/4} = 2$$

Scientific Notation

It's easier to write really big and really small numbers in powers of 10.

$$10^1 = 10,\ 10^2 = 100,\ 10^6 = 1000000,\ \text{etc.}$$

The exponent is essentially a count of 0's after the 1! (****)

Scientific Notation: Example

Instead of writing 89,347,598,324, it would be much easier to write…

$$89347598324 \approx 8.93 \text{ x } 10^{10}$$

Simply move the decimal point 10 places right! *What about very small numbers (-)*?

Caution: Use numbers in the set [1, 10) before the multiplication symbol! (common mistake)

The Metric System: Prefixes

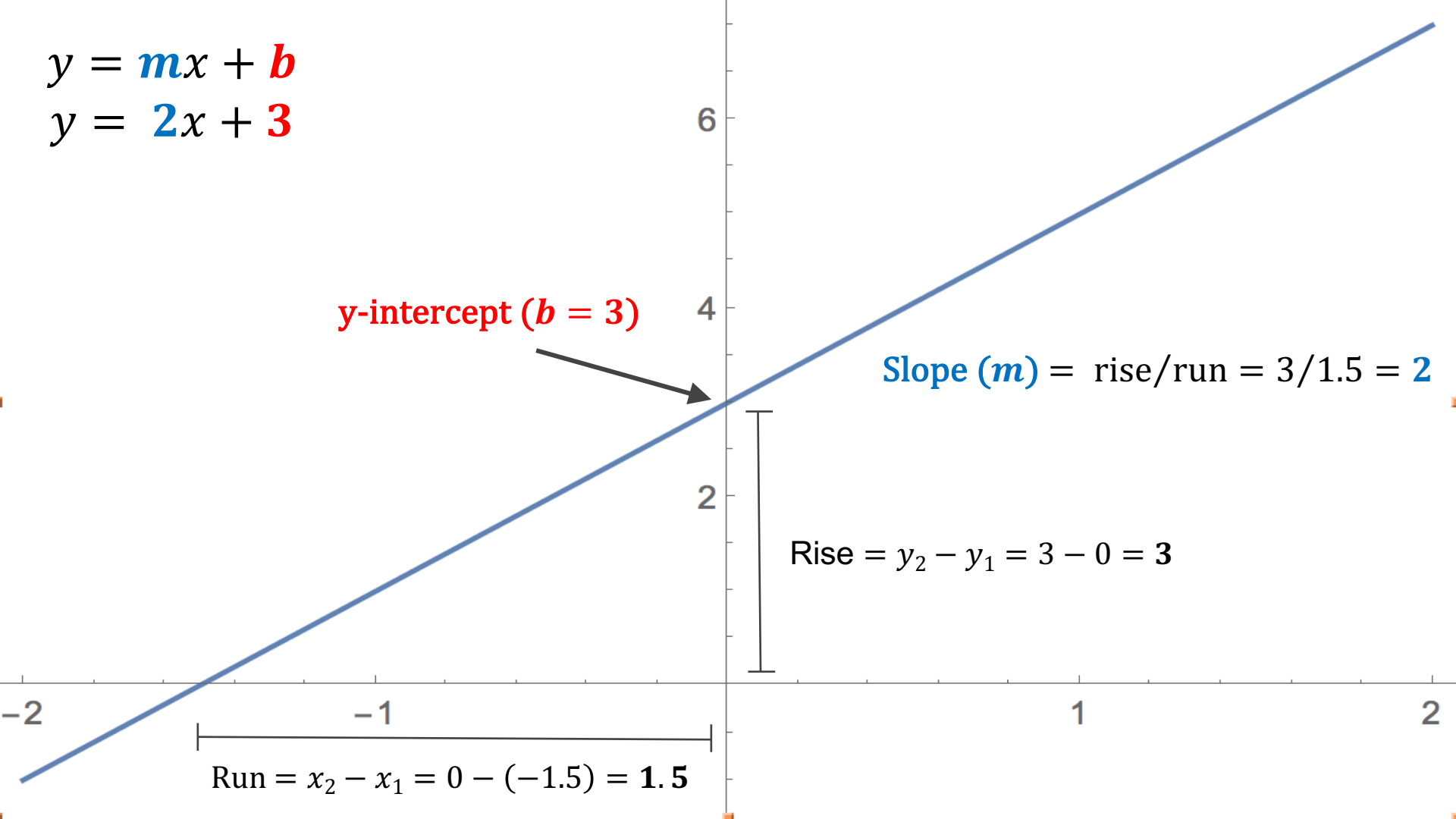
- *Giga-* (**G_**): billion (10^{9})
- *Mega-* (**M_**): million (10^{6})
- *Kilo-* (**k_**): thousand (10^{3})
- *Centi-* (**c_**): hundred**th** (10^{-2})
- *Milli-* (**m_**): thousand**th** (10^{-3})
- *Micro-* (**μ_**): million**th** (10^{-6})
- *Nano-* (**n_**): billion**th** (10^{-9})

Example: What is the best way to write 13.7 billion years?

13.7 billion years → 13.7×10^{9} years
$= 1.37\times10^{10}$ years = 13.7 Gyr

Algebra & Plotting

- What is a variable? How are variables used?
- Expressions vs. Equations: what's the difference?
- Equations are like a numeric balance, and **it's your job to keep that balance.**
- *Solving equations:* remember order of operations (Parentheses, Exponents, Multiplication and Division, and Addition and Subtraction) → **PEMDAS**
- Plotting linear equations: $y = mx + b$ (slope-intercept form)
- The **slope (rise/run)** of the plot is ***m***, and the **y-intercept** is ***b***.
- Example: $y = 2x + 3$
- How would we plot this?


$y = mx + b$
$y = 2x + 3$
y-intercept ($b = 3$)
Slope (m) = rise/run = $3/1.5 = 2$
Rise = $y_2 - y_1 = 3 - 0 = \mathbf{3}$
Run = $x_2 - x_1 = 0 - (-1.5) = \mathbf{1.5}$
6
4
2
−2
−1
1
2

Before we get started...

- **Hand in your math pretest/plagiarism quiz <u>with your name on top</u>** if you haven't already (this is how I will choose your lab groups for next week + beyond).
- Turn in only **<u>ONE lab report per group</u>** before you leave today. You should all be filling out your own copies, but only turning in one copy of the lab report with every group member's name written on the top.
- In lieu of a take-home exercise, this week you only have the short "get to know you" assignment with questions about plagiarism (on the back on the math quiz).
- Future take-homes will be turned in on Canvas (pdf, doc, or docx).
- ***<u>Clarification: No Campus Observatory is required for ASTR 105!</u>***