Parents please read all documents prior to the close of school to begin preparing for next school year!
✓ IS YOUR PRIMARY NUMBER A CELL PHONE LISTING?
  o Update your child’s record and list your cellphone number as the primary contact.
  o Receive text messages with important reminders from school.

✓ JOIN THE PTSA E-MAIL TREE
  o Update your child’s record and list your email to receive important messages from school.
  o Join the PTSA e-mail tree to receive weekly reminders about upcoming events.

✓ CHECK UP ON THE SCHOOL’S WEBSITE:
  o www.fcmartin.dadeschools.net
  o www.fcmpta.org

✓ FOLLOW US ON SOCIAL MEDIA:
  o Twitter – @fcmk8 and @fcmptsa
  o Instagram – @fcminternationalk8
IMPORTANT DATES TO REMEMBER

PROMOTION CEREMONIES:

- Pre-Kindergarten: Friday, May 24 – 8:45 a.m. Cafeteria
- Kindergarten: Thursday, May 30 – 8:45 a.m. Cafeteria
- Fifth Grade: Friday, May 31 – 8:45 a.m. Cafeteria
- Eighth Grade: Thursday, June 6 – 6:00 p.m. Cafeteria

Parents and family members are invited to attend student promotion ceremonies. Please note that due to seat limitations, the number of student guests are capped based on grade level enrollment. Please check with your child’s teacher to ensure that the number of guests can be accommodated.

EARLY DISMISSAL OF ALL STUDENTS:

June 4, June 5, and June 6 – 1:50 p.m.

All students will be dismissed at 1:50 p.m. on the last three days of school. Please ensure arrangements are made for all parent-pick-up students. MDCPS Transportation and ASC will operate at 1:50 p.m.

NO BACKPACKS or LARGE BAGS:

June 6

All students should leave large backpacks and bags at home on the last day of school.

FINAL REPORT CARDS:

June 26

Final report cards will be available for pick-up on or after June 26 from the PYP Office. Parents who wish to have report cards mailed must submit a self-addressed stamped envelope to the homeroom teacher. Include your child’s first and last name and homeroom teachers name on the bottom right-hand corner of the envelope.

SUMMER OFFICE HOURS: 7:30 a.m. – 3:30 p.m. (beginning Monday, June 10, 2019)

All business will be conducted through the PYP Office located on Boggs Drive.
IMPORTANT DATES TO REMEMBER

MYP MANDATORY STUDENT ORIENTATION:

Saturday, July 13, 2019
School Cafetorium
6th & 7th Graders: 9:00 a.m.
8th Graders: 10:15 a.m.

Students will participate in an informative session with teachers, counselors and administration. The students will receive a Humanities grade for attending. Attendance is mandatory! School supplies and uniforms will be available for purchase in the cafeteria. Students will be photographed for the required 2019-2020 student identification badge.

ANNUAL MEET & GREET:

Friday, August 16, 2019
1:30 p.m. through 3:00 p.m.

Parents and students may come between the hours listed above to locate their classroom for the first day, meet the teachers and deliver school supplies to make the first day a great success! The Before and After School Care Program manager will be available for registration and payment. Select school supplies and uniforms will be available for purchase through the PTSA store. Note; Grade Level Supply kits are no longer available through our PTSA Store, we apologize for the inconvenience.

FIRST DAY OF SCHOOL:

Monday, August 19, 2019
Pre-K - Kindergarten 8:20 a.m. - 1:50 p.m.
First - Eighth Grade 8:35 a.m. - 3:05 p.m.

Parents may walk children to the classroom during the first two days of school. Be reminded that parking is limited and you should expect traffic delays during these days. On Wednesday, August 21st and onward, we will institute a CLOSED CAMPUS for the safety of all children. Students will wait in designated areas for teacher pick-up. Parents and students may not wait at the classroom door or throughout the hallway during morning arrival.
CLOSED CAMPUS & SAFETY REMINDERS
2019-2020

- For the safety of your children, Frank C. Martin K-8 Center will be remain a Closed Campus School. All students in Kindergarten through 8th grade will be dropped off in the drop off lot on Boggs Drive or Harrison Street. Adults will not be permitted on campus prior to the opening of the PYP Office at 8:00 a.m.

- To access campus all adults must report to the PYP entrance for a visitor/volunteer pass. Admittance will be allowed providing there is scheduled business to attend to, such as a parent/teacher conference or prearranged volunteer activities.

- Government issued identification is required to enter the building.

- The school will maintain a single point entrance, all school business will take place in the PYP Office located on Boggs Drive. The MYP Office will not be open for service to adults (visitors/volunteers).

- All faculty, staff and MYP students will be required to wear a visible MDCPS issued identification badge at all times while on campus. The first badge will be provided by the school. Additional badges will be at cost of $2.00 to the student. Safety lanyards are recommended, and may be purchased from the school PTSA store for $2.00. After School detentions will be issued for every third day of non-compliance with the mandatory ID badge.

- Uniform policy will be strictly enforced – to include incentives and consequences for violations. Approved outerwear is required. Gray sweatpants will be worn by MYP students on physical education days only. All others must wear uniform styled pants when choosing to wear pants.

- For the safety of all children at Frank C. Martin, please ensure you adhere to the arrival/dismissal procedures as
WELL AS THE FLORIDA TRAFFIC LAWS. BLOCKING THE CROSSWALK IS AGAINST THE LAW, CITATIONS WILL BE ISSUED AT THE DISCRETION OF LAW ENFORCEMENT OFFICERS.

BASIC SAFETY REMINDERS:

- Morning supervision **DOES NOT** begin until 7:45 a.m. – leaving your child unattended prior to supervision puts him/her at a safety risk. Contact the Before/After School Care Office for available services. Repeated early arrival may constitute exit from the Magnet Program.

- Dismissal supervision **ENDS** at 3:25 p.m. on Monday, Tuesday, Thursday and Friday for grades 1 through 8, and at 2:10 p.m. on Wednesday. Supervision for pre-kindergarten through kindergarten ends daily at 2:10 p.m. Leaving your child unattended after supervision ends puts him/her at a safety risk. Contact the Before/After School Care Office for available services. Repeated late pick-up may constitute exit from the Magnet Program.

- Vehicles may not block the crosswalk located at each intersection surrounding the school. This is a violation of the law. Please ensure that your vehicle does not stop, stand or park on the crosswalk.

- Per Metro-Dade Police, it is unlawful for vehicles to pass stopped/standing vehicles on the roadways surrounding the school. You must remain in the lane of the direction in which you are traveling at all times.

- For the safety of our students/parents, no person on foot may enter or exit the cafeteria parking lot during dismissal time. This is a drive-through pick-up lane **ONLY**. Walkers may exit from the main entrance located on Boggs Drive. Parents are not permitted to call students to their vehicles. Parents/Guardians who choose to have students exit the walk up exit MUST park and walk up to the exit to have students dismissed.

**Full details are available on our school website at fcmartin.dadeschools.net**

(Student Handbook)
## 2019-2020 Uniform Policy

### Kindergarten through Fifth Grade Students

<table>
<thead>
<tr>
<th>COLORS</th>
<th>TOPS</th>
<th>BOTTOMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>White or Maroon</td>
<td></td>
<td>Khaki, Navy, or Maroon/Gray Plaid</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FORMS</th>
<th></th>
<th>Uniform Style Pants, Shorts or Skorts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blouse or Polo</td>
<td></td>
<td>Note: Sweatpants, jeans, spandex (form fitted leggings) are NOT permitted</td>
</tr>
</tbody>
</table>

### Sixth through Eighth Grade Students

<table>
<thead>
<tr>
<th>COLORS</th>
<th>TOPS</th>
<th>BOTTOMS</th>
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</thead>
<tbody>
<tr>
<td>Black, Red, Royal Blue</td>
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<td>Khaki or Navy</td>
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<table>
<thead>
<tr>
<th>FORMS</th>
<th></th>
<th>Uniform Style Pants, Shorts or Skorts</th>
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<tbody>
<tr>
<td>Polo</td>
<td></td>
<td>Note: Sweatpants, jeans, spandex (form fitted leggings) are NOT permitted</td>
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<table>
<thead>
<tr>
<th>PE ONLY</th>
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</thead>
<tbody>
<tr>
<td>Gray PE T-Shirt Printed School Logo (Available at our preferred vendor and/or FCM PTSA Store)</td>
<td>Basketball styled short in PLAIN NAVY (absolutely no markings/design)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sweatpants – PLAIN NAVY or GRAY (absolutely no markings)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: form fitted leggings are NOT permitted</td>
</tr>
</tbody>
</table>

### Jackets and Sweaters:

Jackets/Sweaters/Sweatshirts may be worn at any time during the school day providing they comply with the school’s uniform policy. For the safety of our students, outerwear MUST be PLAIN NAVY BLUE (including plain jean jackets) or GRAY. Absolutely no markings or insignia may be printed on outerwear. This is to aid in the easy identification of FCM K-8 students at all times. Hoods may not be worn on the head during the school day and should remain tucked in when not worn.
Failure to comply with the mandatory uniform policy will result in the following:

<table>
<thead>
<tr>
<th>PROGRESSION OF CONSEQUENCES</th>
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</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; – Verbal Notification to Parent/Student</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; – Written Notification to Parent (email and/or agenda)</td>
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<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; – Conduct Cut and Written Notification to Parent</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt; – After School Detention and Written Notification to Parent</td>
</tr>
<tr>
<td>5&lt;sup&gt;th&lt;/sup&gt; - Exclusion from Extracurricular Activities (to include clubs) and Written Parent Notification</td>
</tr>
<tr>
<td>6&lt;sup&gt;th&lt;/sup&gt; – SCM Referral to Administration (Level 1 - Failure to Comply with School Rules), Conduct Cut and Written Notification to Parent</td>
</tr>
<tr>
<td>7&lt;sup&gt;th&lt;/sup&gt; – SCM Referral to Administration (Level 2 – Failure to Comply W/Previous Strategies) and Written Notification to Parent</td>
</tr>
<tr>
<td>8&lt;sup&gt;th&lt;/sup&gt; – Probation Letter, Meeting with Programme Coordinator</td>
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<tr>
<td>9&lt;sup&gt;th&lt;/sup&gt; – Administrative Conference to Consider Programme Exit and Conduct Cut</td>
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# Miami-Dade County Public Schools 2019-2020 School Calendar

**Elementary and Secondary**

<table>
<thead>
<tr>
<th>July 2019</th>
<th>August 2019</th>
<th>September 2019</th>
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<tbody>
<tr>
<td>M T W T F</td>
<td>M T W T F</td>
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<th>October 2019</th>
<th>November 2019</th>
<th>December 2019</th>
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<td>4 5 6 7 8 9</td>
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<td>15 16 17 18 19</td>
<td>20 21 22 23</td>
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<td>(24)</td>
<td>16 17</td>
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<tr>
<th>January 2020</th>
<th>February 2020</th>
<th>March 2020</th>
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<td>M T W T F</td>
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<td>3 4 5 6</td>
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<td>7 8 9 10 11</td>
<td>12 13 14 15 16</td>
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<td>17 18 19 20 21</td>
<td>22 23 24 25</td>
<td>26 27 28 29 30</td>
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<tr>
<th>April 2020</th>
<th>May 2020</th>
<th>June 2020</th>
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<tbody>
<tr>
<td>M T W T F</td>
<td>M T W T F</td>
<td>M T W T F</td>
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<td>1 2 3</td>
<td>1 2 3</td>
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<tr>
<td>4 5 6 7 8 9</td>
<td>4 5 6 7 8 9</td>
<td>1 2 3 4 5</td>
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<tr>
<td>10 11 12 13 14</td>
<td>15 16 17 18 19</td>
<td>20 21 22 23 24</td>
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<tr>
<td>25 26 27 28 29</td>
<td>30</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>

### Days in Grading Period

- 1-46
- 2-44
- 3-44
- 4-46

For information on employee opt days, please refer to back of calendar.
FRANK C. MARTIN INTERNATIONAL K-8 CENTER
EIGHTH GRADE SUPPLIES LIST 2019-2020

General Supplies are Required Daily for All Students

- Personal Headphone or Earbuds (For Use in Classroom, Lab, and Media Center)
- 1 (4 gigabyte or larger) USB Flash Drive
- 1 FCM Agenda Book ($6.00 available through FCM PTSA Store)
- 1 Safety Lanyard (for use with school issued I.D. Badge)
- Student Identification Badge (Must be worn and visible each day)

Language & Literature (8th grade)

- 1 - 1-Inch 3-Ring Binder
- 5 - Dividers with Tabs
- 5 - Clear Plastic Page Protectors
- Loose-Leaf Paper
- Pens
- Pencils
- Highlighters
- Sticky Notes
- Index Cards
- Lysol/Clorox Wipes
- Magazine ($12.00)

Novels for 8th grade
Regular, Advanced and Gifted:
Ghost of Spirit Bear, Ben Mikaelsen
Advanced and Gifted:
Whirligig, Paul Fleischman

Language Acquisition (French)

- 1 – Plastic Duotang Folder with prongs (any color, not marked with student name)
- 6 - Plastic sheet protectors
- 1 - Composition Book
- 1 - Blue/Black Pen
- 1 – set colored pens for taking notes
- 1 - Highlighter
- 3 - Sharpened Pencils
- 1 – Glue Stick
- 1 – box crayons or colored pencils
- 1 - English/French Dictionary (Larousse)
- 1 – Ream of copy paper
Language Acquisition (Spanish)
- 1 - Composition Notebooks
- 1 - Duo Tang Folder with pockets
- 1 - pencil pouch with 3 (# 2) pencils
- 1 - Red/green pen for checking
- 1 - Blue or black pen for writing
- 1 - Glue stick
- 1 - Highlighter
- 1 - Spanish/English Dictionary (70,000 words or more)
- Crayons or colored pencils
- Loose Leaf Paper
- 1 – Roll of Paper Towels
- 1 – Large Box of Kleenex Tissues

Individuals & Societies – World History (8th Grade)
- 1 - Three-Ring Binder
- 3 - Dividers
- Colored Pencils
- Blue or Black Ink Pens
- Wide or College Ruled Loose Leaf Paper

Science (8th Grade)
- 1 - Composition Notebook (will serve as lab notebook)
- Red-blue-black pens (pencils are a given)
- 1 - 12inch metric ruler
- 1 - highlighter (color does not matter)
- Science Lab fees: Physical Science and Biology - $8.00 / Comprehensive Science $4.00

Mathematics (8th Grade)
- 1 - Composition Book
- 1 - Ruler (cm./in.)
- 2 - Red Pens
- Pencil Sharpener
- Pencils
- Erasers
- Highlighter
- Protractor and Compass
- ½ inch Graph Paper
- 1 - 3-Ring Binder (1-Inch with 3 Dividers) and College Ruled Loose Leaf Paper
- 2 - Folders with Pockets (Blue and Red)
- 1 - Inexpensive 4-Function Calculator
- 2 - Packets of 3X5 Index Cards
- 1 - Scientific Calculator (with Sin, Cos, & Tan) (Geometry Only)
• Colored pencils (Geometry Only)

_Music (All Band & Orchestra)_

• Mechanical Pencils
• Extra Erasers
• Black Duo-tang Folder with Pockets
• Loose-Leaf Paper
• Ream of Copy Paper
• Sheet Protectors for Music Sheets (Qty:25) - Orchestra Only
• Rosin - Orchestra Only
• Instrument with personal cleaning kit
  (new students will select instrument at start of year)
• Folding music stand (for home use and performance field trips)
• Band 1 - Essential Elements Band Book 1
  (After students select their instrument)
• Orchestra 1 - Essential Elements Orchestra Book 1
  (After students select their instrument)
• Band 2 & 3 - Essential Elements Band Book 2
• Orchestra 2 & 3 - Essential Elements Band Book 2
• Essentials of Music Theory – Complete Edition (Band & Orchestra)
• Band 1 and Orchestra 1 students should not purchase instrument or
  instrument supplies until they are assigned the instrument that they will be
  learning.
• Music/Instrument Fee $10 fee (music acquisition/repair replacement)

_Design (Technology)_

• 1 Ream of Copy Paper
• 1 Bottle of Hand Sanitizer
• 1 Container of Disinfecting Wipes (Clorox)
• 1 Box of Tissues
• 1 USB Flash drive: M or G Bytes)
• 1 Large Eraser
• 1 Black Permanent Marker (To be kept in class)
• $5.00 Technology/Design Fee

_Physical & Health Education_

• 1 Plastic Duo tang Folder with Pockets
• 2 Pens/pencils
• PE Uniform Shirt (IBILEY or FCM PTSA Store)
• PLAIN Navy Blue Shorts
• PLAIN Gray Sweat Pants (No Leggings Permitted)
• Sneakers
Theatre Arts

- 1 Composition book (process journal)
- 1 One-inch RED plastic binder with loose leaf paper and dividers
- 6 #2 pencils (no mechanicals) & erasers
- 2 Red/green pens & highlighters
- 1 Pack 12+ Colored pencils
- 1 Pack 24+ Crayons
- 1 Glue Stick
- 1 Pack 4X6 Index Cards
- 1 Red folder

Art (supplies may be purchased through the PTSA Store)

- 1 - 8½ X 11 Sketchbook
- 1 - Magic Rub eraser
- 1 Sharpener
- 12 #2 wood pencils.
- 1 Set of Graphite Pencils 2H, HB, B, 2B, 4B, and 6B
- 1 Art Student’s Portfolio – 12” X 18” or Larger
  (suggested: Red Wallet Portfolio 12 X 18)
- Art Fee - $2.00 (collected during Fee Week)

Please label all student’s art material
Middle Years Programme Summer Reading & Writing Requirements
Frank C. Martin K-8 Center

Summer Reading Requirements: According to the grade-level you will be entering in August 2019, you MUST read the novel(s) listed and be prepared to partake in graded activities, involving these novels once school begins.

6th Grade (Select and read two from the list below)

- A Single Shard, by Linda Sue Park
- Hoot or Flush, by Carl Hiaasen
- Bud, Not Buddy, by Christopher Paul Curtis
- The Boy in the Striped Pajamas, by John Boyne

7th Grade (Read both selections below)

- The Westing Game, Ellen Raskin
- Seedfolks, Paul Fleischman

8th Grade (Read the selection below)

- Touching Spirit Bear, Ben Mikaelsen

Summer Writing Requirements: 6th-7th-8th grade students will keep a summer journal or travel log with a minimum of one entry per week—10 entries in total. Each entry must be at least one full page in length and include the date the entry was written. Please bind your entries together to make a booklet—be creative! All entries must be typed. ABSOLUTELY NO notebooks, composition books, folders, etc. will be collected. Listed below are suggested writing ideas.

- Reflect on or summarize the book(s) you are reading
- Write a letter to a character from the book(s) you are reading
- Create a timeline of major events from the book(s) you are reading
- Choose a newspaper or magazine article that interests you and write a reaction
- Visit a historical landmark and write about the experience
- Write a letter to a friend or relative—real or imaginary
- Write about your personal feelings and/or experiences during the summer
- Write about the expectations you have for yourself next school year
- Tell about your summer travels—even if you only travel locally
- Tell about community service projects you participate in over the summer
- Describe the camp you attend over the summer
- Describe any sports activities you participate in, or games you play
- Watch the sunset and describe what you see
- Make a bucket list of all the things you hope to accomplish one day
- Summarize each week of summer—ups and downs, exciting or boring
- Write about a day in the life of a cat, dog, fish, turtle, etc.
Dear Students and Parents:

The purpose of this packet is to review math concepts as you look forward to Pre-Algebra next year. All concepts in this packet have been previously covered in 7th grade. Please use this summer to assure all pre-requisite concepts have been understood. This packet will be checked for completion by the end of the first week back in September. **Show all your work for each problem.** Your child will receive extra credit for completing the packet!!

Have a wonderful summer!

**Order of Operations**

1) \(14 \div 7 + 3^2\)  
2) \(42 \div 2(-12 + 9)\)  
3) \(\sqrt{49}\)  
4) \(|-14|\)

5) \(18 - 30 \div 5\)  
6) \(48 \div (5 + 7) - 9\)  
7) \(4^3 - 5(2) + 13\)

**Adding/Subtracting/Multiplying/Dividing Positive and Negative Numbers**

8) \(-2 + 11 - 7\)  
9) \(5 - 3 + 12 - (-9)\)  
10) \(-\frac{4}{3}\) \(-\frac{4}{3}\)

11) \((-2)(4)(-5)(-1)\)  
12) \(-4 + -9 - 3(-6)\)  
13) \(\left(\frac{3}{5}\right)\left(-\frac{7}{12}\right)\)

14) \(\frac{3}{4} + \frac{1}{6}\)  
15) \(2\frac{1}{3} - \frac{7}{9}\)  
16) \(\left(\frac{2}{3}\right) \div \left(\frac{15}{9}\right)\)
Evaluating Expressions

17) \(3(n - 1) + 2n\), when \(n = 5\) 

18) \(7b - 2a\), when \(a = -3\) and \(b = 4\)

19) \(3x^2 + 5x + 1\), when \(x = -2\) 

20) \(\frac{2r}{t} + 7\), when \(r = 12\) and \(t = 3\)

21) \((3x)^2 - 7y^2\), when \(x = 3\) and \(y = 2\) 

22) \(4(3d + 6) - 2d\), when \(d = -6\)

Solving Equations

Here is an example:

\[
\begin{align*}
3b + 2 &= 6(3 - b) \\
3b + 2 &= 18 - 6b \\
-2 - 2 &= 3b - 16 + 6b \\
-3b &= 16 - 6b \\
+6b &= 16 + 6b \\
9b &= 16 \\
b &= \frac{16}{9}
\end{align*}
\]

Check:
Does \(3(\frac{16}{9}) + 2 = 6(3 - (\frac{16}{9}))\)?

\[
\begin{align*}
\frac{16}{3} + 2 &= 6(\frac{11}{9}) \\
\frac{16}{3} + \frac{6}{3} &= \frac{22}{3} \\
\frac{22}{3} &= \frac{22}{3} \checkmark
\end{align*}
\]

Solve the equation.

23) \(14 = b + 5\) 

24) \(5r = 22\) 

25) \(\frac{x}{4} = -9\)

26) \(3x - 5 = 13\) 

27) \(\frac{1}{4}d + 2 = 3\) 

28) \(-21 - 5x = 64\)
29) 3y + 2y = 81 - 6  
30) 18y - 21 = 15y + 3  
31) \frac{2a}{7} = \frac{2}{3}

32) 2x - 10 + 2 = 12  
33) 3(y - 4) = -2y - 12  
34) \frac{4x}{7} = \frac{6}{5}

**Properties**

Match each equation on the left with the property it illustrates on the right.

35) 4 + (9 + 6) = (4 + 9) + 6  
A. Identity Property of Addition

36) x + 12 = 12 + x  
B. Associative Property

37) (3 + y) + 0 = 3 + y  
C. Distributive Property

38) x \cdot 1 = x  
D. Identity Property of Multiplication

39) 5(x + y) = 5x + 5y  
E. Commutative Property

**Distributive Property**

Simplify each expression using the distributive property.
Example: 4(x + 5) = 4(x) + 4(5) = 4x + 20

40) 3(b + 9)  
41) 5(2x - 3)  
42) -3(4x + 9)

43) x(2x + 4)  
44) \frac{1}{2}(4r + 12)  
45) -(6p - 11)

**Simplifying Expressions**

Simplify each expression by distributing and combining like terms.

53) 4x + 7y - 14x + 2y

54) -13 - 4y - 5z + 15 - (-4z) + 11y

55) 20xy + 3x^2y - 10x^2y - 30xy

56) -3(2x - 5y)

57) 9(6 + 2y) - 5 + 2y

58) 2(3x - 1) + 3(x + 7)

59) 9(2x + 4) - 2(3x - 1)
Translating Expressions and Equations

Write an algebraic expression or equation to represent each verbal expression.

Example: 18 less than the quotient of a number and 3. \( \frac{n}{3} - 18 \)

60) The sum of six times a number and 25

61) 7 less than fifteen times a number

63) Four times the square of a number increased by five times the same number

64) The sum of a number and 23 is 78.

65) The sides of a rectangle are a number and 4 less than that same numbers. The perimeter is 56. Find the dimensions of the rectangle.

66) If a number is decreased by 6, and the result is multiplied by 3, than the answer is 15. Find the unknown number.
WEBSITES

Use these websites for extra Math practice.

- mathplayground.com – Logic games.
- multiplication.com – Games utilizing the basic Math facts of addition, subtraction, multiplication and division.
- funbrain.com – More than just Math.
- mathvids.com – An abundance of Math videos to help teach concepts from integers, to absolute value, to fractions and so much more.
- coolmath4kids.com – Math games.
- ixl.com/math – Extra practice on many different topics in Math.
To access the Algebra 1 Readiness Summer Packet follow the steps below

**STEP 1:** Log onto your student portal

**STEP 2:** Select the Resources tab near the top of the page

**STEP 3:** Go to District Documents and select student documents

**STEP 4:** Go to District Documents and select Math

**STEP 5:** Go to District Documents and select Summer Learning
GEOMETRY, HONORS
(For students enrolled in Geometry, Honors)

NO WORK = NO CREDIT (GRADED FOR CORRECTNESS)

Use your old notes to help you, and if possible, the internet. (kahn academy, ixl, purple math, etc.)

Try something, even if it is wrong.

NOT HAVING A CALCULATOR IS NO EXCUSE
FOR NOT COMPLETING A PROBLEM.
FIND A WAY.

Show the work on your own paper. It is suggested that you do a little at a time.

Good luck and have a great summer!
Objectives for Honors Geometry Summer Packet
2019-2020

I. Finding the Equation of a Line (Problems: #1-8)
   • Given a point that lies on that line and the y-intercept
   • Given two points that lie on that line

II. Distance Formula (Problems: #9-12)
   • Use the distance formula to find the distance between two points
   • Solving equations involving radicals

III. Solving Equations (Problems: #13-20)
   • Solving equations with variables on both sides
   • Using order of operations
   • Using properties of equality

IV. Systems of Equations (Problems: #21-25)
   • Using the linear combination method to solve systems of equations
   • Using the substitution method to solve systems of equations

V. Radicals (Problems: #26-35)
   • Simplifying radicals
   • Squaring radicals
   • Rationalizing radicals

VI. Proportions (Problems: #36-39)
   • Solving proportions by cross multiplying
   • Solving proportions using equivalent fractions
   • Solving equations involving inverse operations

VII. Quadratic Equations (Problems: #40-41)
   • Solving quadratic equations by taking the square root of both sides
   • Using properties of equality
   • Solving quadratic equations by factoring (Problems: #51-60)

VIII. The Pythagorean Theorem (Problems: #44-47)
   • Using the Pythagorean theorem to find missing lengths in right triangles
   • Using properties of equality

IX. The Midpoint Formula (Problems: #48-50)
   • Identifying the x coordinate and the y coordinate in an ordered pair
   • Using the midpoint formula to find the midpoint of two points
Finding the Equation of a Line

Example: Find an equation of the line that passes through the point (3, 4) and has a y-intercept of 5.

\[ y = mx + b \]
Write the slope-intercept form.

\[ 4 = 3m + 5 \]
Substitute 5 for \( b \), 3 for \( x \), and 4 for \( y \).

\[ -1 = 3m \]
Subtract 5 from each side.

\[ \frac{-1}{3} = m \]
Divide each side by 3.

The slope is \( m = \frac{-1}{3} \). The equation of the line is \( y = \frac{-1}{3}x + 5 \).

Exercises: Write the equation of the line that passes through the given point and has the given y-intercept.

1. \((2, 1); b = 5\) ____________________ 2. \((7, 0); b = 13\) ____________________

3. \((-11, 8); b = -14\) ____________________ 4. \((-2, -1); b = -5\) ____________________

Finding the Equation of a Line

Example: Write an equation of the line that passes through the points \((4, 8)\) and \((3, 1)\).

Find the slope of the line.

\[ m = \frac{1-8}{3-4} \] Substitute values.

\[ m = \frac{-7}{-1} = 7 \] Simplify.

Alternative Method:

Find the slope of the line. \( m = 7 \)

Set up a proportion using the slope and one point on the line.
\[ 1 = 7(3) + b \quad \text{Substitute values into } y = mx + b \]
\[ \frac{7}{1} = \frac{y-8}{x-4} \]

\[ 1 = 21 + b \quad \text{Multiply.} \]
\[ -20 = b \quad \text{Solve for } b. \]

Cross-multiply.
\[ 7(x - 4) = 1(y - 8) \]

Distribute
\[ 7x - 28 = y - 8 \]

The equation of the line is \( y = 7x - 20 \).

Place in standard form.
\[ 7x - y = 20 \]

Exercises: Write an equation of the line that passes through the given points.

5. \((6, 3), (1, 2)\) \______________________ 6. \((-2, 4), (3, -6)\) \______________________

7. \((6, -2), (0, 4)\) \______________________ 8. \((10, -9), (14, -1)\) \______________________

Distance Formula

Example: Find the distance between the points \((-4, 3)\) and \((-7, 8)\).

Formula:
\[ d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \]
\[ d = \sqrt{(-7 - (-4))^2 + (8 - 3)^2} \]
\[ d = \sqrt{(-3)^2 + (5)^2} \]
\[ d = \sqrt{34} \]

Exercises: Find the distance between the points.

9. \((3, 6), (0, -2)\) \______________________ 10. \((5, -2), (-6, 5)\) \______________________

11. \((-6, -6), (-3, -2)\) \______________________ 12. \((-8, 5), (-1, 1)\) \______________________
Solving Equations with Variables on Both Sides

Examples:

a. \(6a - 12 = 5a + 9\)  
   Subtract 5a from each side.  
   \(a = 21\)  

b. \(6(x + 4) + 12 = 5(x + 3) + 7\)  
   \(6x + 24 + 12 = 5x + 15 + 7\)  
   Add 12 to each side.  
   \(6x + 36 = 5x + 22\)  
   \(x = -14\)

Exercises: Solve the equation.

13. \(3x + 5 = 2x + 11\)  
14. \(y - 18 = 6y + 7\)

15. \(-2t + 10 = -t\)  
16. \(60c - 54(c - 2) = 0\)

17. \(-\frac{1}{2}(16 - 2h) = 11\)  
18. \(1 + j = 2(2j + 1)\)

19. \(4x + 2(x - 3) = 0\)  
20. \(\frac{3 + m}{2} = 5\)

Solve the System of Equations:

Example 1: Linear Combination Method

\[
\begin{align*}
4x - 3y &= -5 \\
7x + 2y &= -16
\end{align*}
\]

The goal is to obtain coefficients that are opposites for one of the variables.

\[
\begin{align*}
4x - 3y &= -5 \quad \text{Multiply by 2} \quad 8x - 6y &= -10 \\
7x + 2y &= -16 \quad \text{Multiply by 3} \quad 21x + 6y &= -48
\end{align*}
\]

29x = -58
\(x = -2\)

Substitute -2 for x: \(4(-2) - 3y = -5\). Solve to get \(y = -1\). The solution is \((-2, -1)\)

Example 2: Substitution Method

\[
\begin{align*}
3x + 2y &= 16 \\
x + 3y &= 10 \quad \Rightarrow \quad x &= 10 - 3y
\end{align*}
\]
Now substitute $10 - 3y$ for $x$ in the first equation: $3(10 - 3y) + 2y = 16$.
Solve for $y$ to get $y = 2$.

Substitute 2 for $y$: $x = 10 - 3(2)$. Solve to get $x = 4$. The solution is $(4, 2)$.

21. $2x - 3y = -16$
22. $x + y = 8$
23. $9x + 4y = 3$
   $y = 5x + 1$
   $2x + 5y = 3$
   $x + 8y = 6$

24. $4x - 5y = 18$
   $3x + 10y = -3$

25. $8x + y = -8$
   $-2x - 3y = 35$

**Simplifying Radicals**

Examples:

a. $\sqrt{20} = \sqrt{4 \cdot 5} = 2\sqrt{5}$
b. $(3\sqrt{5})^2 = (3\sqrt{5})(3\sqrt{5}) = 9 \cdot 5 = 45$
c. $\frac{6}{\sqrt{5}} = \frac{6\sqrt{5}}{\sqrt{5} \cdot \sqrt{5}} = \frac{6\sqrt{5}}{5}$

Exercises: Simplify the expression.

26. $\sqrt{45} =$
27. $\sqrt{40} =$

28. $\sqrt{288} =$
29. $\sqrt{52} =$

30. $(\sqrt{8})^2 =$
31. $(6\sqrt{3})^2 =$

32. $(5\sqrt{7})^2 =$
33. $\frac{5}{\sqrt{5}} =$

34. $\frac{4}{\sqrt{8}} =$
35. $\frac{3\sqrt{5}}{\sqrt{20}} =$
Solving Proportions

Examples:  a. \( \frac{x}{8} = \frac{3}{4} \)  \hspace{1cm} \text{Cross Multiply}  \hspace{1cm} \text{b.} \hspace{1cm} \frac{6}{x+4} = \frac{1}{9}  \hspace{1cm} \text{Cross Multiply}

4x = 8 \cdot 3  \hspace{1cm} 6 \cdot 9 = x + 4
4x = 24  \hspace{1cm} 54 = x + 4
x = 6  \hspace{1cm} 50 = x

Exercises: Solve.

36. \( \frac{x}{20} = \frac{1}{5} \)  \hspace{1cm} 37. \( \frac{6}{m} = \frac{19}{95} \)

38. \( \frac{3w+6}{28} = \frac{3}{4} \)  \hspace{1cm} 39. \( \frac{3}{p-6} = \frac{1}{p} \)

Solving Quadratic Equations

Example: \( x^2 - 5 = 16 \)
\[ x^2 = 21 \] \hspace{1cm} \text{Add 5 to both sides}
\[ x = \pm \sqrt{21} \]

Exercises: Solve.

40. \( x^2 + 3 = 13 \)  \hspace{1cm} 41. \( 7x^2 = 252 \)

42. \( 4x^2 + 5 = 45 \)  \hspace{1cm} 43. \( 11x^2 + 4 = 48 \)

Pythagorean Theorem:

Examples:  a. \( a = 12, b = 35, c = \)  \hspace{1cm} \text{b.} \hspace{1cm} \text{a} = 10, \text{ b} = \), \text{c} = 26

\[ a^2 + b^2 = c^2 \]  \hspace{1cm}  \[ a^2 + b^2 = c^2 \]
\[(12)^2 + (35)^2 = c^2 \]  \hspace{1cm}  \[ (10)^2 + b^2 = (26)^2 \]
\[ 144 + 1225 = c^2 \]  \hspace{1cm}  \[ 100 + b^2 = 676 \]
\[ 1369 = c^2 \]  \hspace{1cm}  \[ b^2 = 576 \]
\[ \sqrt{1369} = c \]  \hspace{1cm}  \[ b = \sqrt{576} \]
\[ 37 = c \]  \hspace{1cm}  \[ b = 24 \]
Exercises: Use the triangle above. Find the length of the missing side.

44. $a = 36, b = 15, c =$ _____________  
45. $a = 17, b =$ _____________, $c = 49$

46. $a =$ _____________, $b = 13, c = 24$  
47. $a = 19, b = 45, c =$ _____________

Midpoint Formula

Example: Find the midpoint between $(8, 14), (2, 6)$.

Formula: $\left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

$\left( \frac{8 + 2}{2}, \frac{14 + 6}{2} \right)$

$\left( \frac{10}{2}, \frac{20}{2} \right)$

$(5, 10)$

The midpoint is always an ordered pair!

Exercises: Find the midpoint between the given points.

48. $(-3, 5)$ and $(8, 9)$ ________________

49. $(-7, -17)$ and $(11, 4)$ ________________

50. $(3, -8)$ and $(-5, -13)$ ________________

Solving quadratic equations by factoring

Example: Solve $2x^2 - x = 3$

$2x^2 - x - 3 = 0$ set equation equal to zero

$(2x - 3)(x + 1) = 0$ Factor

$2x - 3 = 0$ or $x + 1 = 0$ set both equal to zero

$x = \frac{3}{2}$ or $x = -1$ solve for $x$
\( \left\{ \frac{3}{2}, -1 \right\} \) are the solutions

Solve by factoring

51. \( x^2 + 7x + 10 = 0 \) _________________

52. \( x^2 - x = 12 \) _________________

53. \( x^2 - 6x = -8 \) _________________

54. \( 2x^2 + 5x + 3 = 0 \) _________________

55. \( 3x^2 + 2x - 8 = 0 \) _________________

56. \( x^2 - 3x - 28 = 0 \) _________________

57. \( 2x^2 - x - 10 = 0 \) _________________

58. \( 6x^2 + 2x = 4 \) _________________

59. \( 2x^2 - 6x = 0 \) _________________

60. \( x^2 + 7x = 0 \) _________________
What is Earth Science?
Use the following links to read about Earth Science and answer the following questions:
https://www.vmnh.net/content/File/VSSI_1_2012/nospresentation72112.pdf
https://www.youtube.com/watch?v=_tvWDPBNiD4
https://geology.com/articles/what-is-earth-science.shtml
https://www.livescience.com/46252-earth-science.html
https://www.livescience.com/20896-science-scientific-method.html

The Nature of Science
**Write true if the statement is true or false if the statement is false.**

_____ 1. Science is both a way of gaining knowledge and a body of knowledge.
_____ 2. There is no place for imagination and creativity in science.
_____ 3. All science is based on evidence and logical thinking.
_____ 4. Any idea can be investigated through scientific inquiry.
_____ 5. Scientific investigations always follow the same sequence of steps.
_____ 6. A good experiment must have one factor that can be manipulated.
_____ 7. Data in the form of numbers is called qualitative data.
_____ 8. Taking many measurements and averaging the results may correct random errors in data.
_____ 9. If data from an experiment do not support a hypothesis, then the experiment is a failure.
_____ 10. A scientific theory is just an educated guess about why something occurs.

Read this passage below and answer the questions that follow.

The Importance of Community in Science

Although each scientist may perform experiments in her lab alone or with a few helpers, she will write up her results and present her work to the community of scientists in her field. Initially, she may present her data and conclusions at a scientific conference, where she can talk with other scientists and get feedback on her work. Using what she learns, she may go on to write a professional paper about her research and submit it to a scientific journal. Before the paper is accepted for publication, several scientists who are experts in the same field will review it. This is called peer review. These other scientists may suggest changes to the paper, and they will recommend whether or not the paper should be published. Once a paper is published, other scientists can learn about the work and may incorporate the results into their own research. Some scientists may try to replicate the experiment to see whether they get the same results. In this way, the
knowledge base of science builds toward a greater understanding of nature.

The scientific community influences the quality and type of research that is done by scientists. For example, other scientists help determine which research projects receive funding. Most scientific research is expensive, so a scientist must write a research proposal to a funding agency, such as the National Science Foundation, requesting money to pay for equipment, supplies, and salaries. Scientific proposals are reviewed by other scientists in the field. In many fields, the funding rate is low and the money goes only to the most worthy research projects.

The scientific community monitors scientific integrity. During their scientific training, students learn how to conduct good scientific experiments. They learn not to fake, hide, or selectively report data. They also learn how to fairly evaluate data and the work of other scientists. Considering how much scientific research is done, there are very few incidents of scientific dishonesty. However, when such an incident occurs, it generally receives a lot of media attention. This may cause the public to mistrust scientists and scientific research in ways that are unfounded. Scientists who do not have scientific integrity are strongly condemned by the scientific community.

Questions

1. What is peer review, and why is it important?

2. How does the scientific community influence the quality and type of scientific research that is done? How does the scientific community promote scientific integrity?
Multiple Choice:

Circle the letter of the correct choice.

1. Which of the following is a valid science lab safety guideline?
   a. Do not eat or drink anything while in the lab.
   b. Wear a drawstring hoodie to protect yourself from chemicals.
   c. Wait to clean up any spills until you complete the lab procedure.
   d. Change the lab procedure if necessary to improve the experiment.

2. Which of the following is relevant to scientific inquiry?
   a. moral judgments
   b. personal opinions
   c. assumptions about nature
   d. none of the above

3. Which of the following ideas are basic to science?
   a. Rules of nature may be different elsewhere in the universe.
   b. Once accepted, scientific ideas are not subject to change.
   c. Natural events and processes have natural causes.
   d. All of the above

4. To be useful, a scientific hypothesis must
   a. be true.
   b. be testable.
   c. be very specific.
   d. apply in all situations.

5. Scientists may collect data by
   a. doing experiments.
   b. making observations.
   c. taking measurements.
   d. all of the above
6. Assume that a scientist is measuring mass in an experiment. The balance she is using is not set at zero, so it always measures mass a little too high. What type of error does this cause in her data?

   a. random error
   b. observer error
   c. systematic error
   d. two of the above

**Lesson 1.1: Matching**

*Match each definition with the correct term.*

**Definitions**

_____ 1. testable, plausible explanation for a scientific question
_____ 2. series of steps scientists use to investigate questions
_____ 3. factor that must remain the same in an experiment so it does not affect the outcome
_____ 4. factor in an experiment that the researcher changes
_____ 5. scientific explanation that is supported by many observations
_____ 6. factor measured as the outcome of an experiment
_____ 7. useful representation of a real system that is simpler than reality

**Terms**

a. hypothesis  
b. theory  
c. control  
d. dependent variable  
e. independent variable  
f. model  
g. scientific method

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

1. The scientific method typically begins with a(n) _________.
2. Before developing a hypothesis, a scientist typically undertakes _________.
3. A physical representation of a real object, such as a globe of the world, is a(n) ________ model.
4. If a hypothesis is tested and supported repeatedly, it may become a(n) _________.
5. A general idea about how something works is a(n) ________ model.
6. The scientific method typically ends with a(n) __________.
7. A set of equations that represents a real-world process is a(n) __________ model.

**Earth Science and Its Branches**

*Write true if the statement is true or false if the statement is false.*

- 1. Earth science deals with Earth’s lands, oceans, and atmosphere.
- 2. Most Earth scientists specialize in studying one aspect of the planet.
- 3. Seismologists forecast major storms to save lives and property.
- 4. Oceanography can be accurately defined as the hydrology of the oceans.
- 5. Meteorologists collect data using technologies such as radar and satellites.
- 6. All the branches of Earth science are connected.
- 7. A lunar geologist might study minerals and rocks under the oceans.
- 8. Climatologists are interested in long-term changes in the atmosphere.
- 9. Environmental science is the study of how the environment affects people.
- 10. Astronomy is defined as the study of the geology of other planets.

**Critical Reading**

*Read this passage based on the text and answer the questions that follow.*

**Introduction to Earth Science**

Earth science consists of many branches of knowledge concerning planet Earth. It deals with any and all aspects of Earth: its lands, interior, atmosphere, and oceans. Earth is a very large and complex set of systems. Therefore, most Earth scientists focus on just one aspect of the planet.

The main branches of Earth science are geology, meteorology, climatology, oceanography, and environmental science. Each branch has a different focus. For example, geology focuses on Earth’s solid materials and structures and the processes that create them. Geology, in turn, is divided into several branches, including mineralogy, planetary geology, marine geology, and seismology. Mineralogy, for example, is the study of the composition and structure of minerals. Seismology is the study of earthquakes and their causes. Because all of Earth’s systems are interconnected, researchers in different branches of Earth science generally must work together to answer complex questions.

**Questions**

1. What is Earth science? Why does Earth science have many branches?
2. Identify the main branches of Earth science.

3. What is the focus of the branch of Earth science known as geology? How is geology divided into branches?

Fill in the Blank

*Fill in the blank with the appropriate term.*

1. Scientists who study the composition and structure of minerals are called __________.
2. __________ are scientists you study the geology of other planets.
3. The study of water and its movements, distribution, and quality is __________.
4. The study of everything in the ocean environment is __________.
5. A(n) __________ studies ocean currents, waves, and tides.
6. A(n) __________ studies rocks and geologic processes of ocean basins.
7. A(n) __________ studies life in the oceans.
Critical Writing

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

What is a question that might be investigated by an environmental scientist?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Identify another branch of Earth science that might be called upon to help answer the question. Explain your choice.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
What is the Scientific Method? It is a series of steps used to help solve a problem.

**Step 1. Make an Observation.** After making an observation of the natural world, define the problem and make sure only one problem is being studied. ALL scientific experimentation starts with observation.

**Step 2. Research the problem (question).** Use all available resources to collect data on the subject being covered. Libraries, Internet, books, magazines, personal interviews, etc.

**Step 3. Develop a hypothesis (educated guess).** Make it a short definitive statement. It may be an “if-then” statement. The “if” part will become the hypothesis and the “then” part should be the results received at the end of the controlled experiment. Remember your hypothesis can be changed if the results do not support it.

**Step 4. Develop a controlled experiment.** A controlled experiment is an experiment that contains only one experimental variable. **An experimental or independent variable is the thing being tested (what the scientist changes).** Everything else in the experiment or all other variables must be the same. These variables are also called the controlled variables. Keeping these variables the same allows the experimenter to show that it was the experimental variable that caused the results. The dependent variable is what changes when the independent variable changes - the dependent variable **depends** on the outcome of the independent variable. **Data should be organized into charts, tables, or graphs.**

**Step 5. Analyze the data and come up with a conclusion.** Data may be quantitative (numbers) or qualitative (appearance, properties, etc.). The conclusion may or may not support the hypothesis. Additional experimentation must then take place to build documentation concerning the problem. If the hypothesis is proven wrong, change the hypothesis, not the data. Scientists must be unbiased.

**WHAT FOLLOWS:** Scientific research must be published, but first it must be reviewed by peers (other scientists) and verified for accuracy. Research may result in a scientific theory or law.

---

Read each scenario below & use your knowledge of the scientific method to help answer the questions.

8.) Flower Flourish
Jeremy has decided that he really likes Candace. He wants to start a flower garden so he can grow lots of flowers to give to her. He bought a special fertilizer called Flower Flourish to see if it will help his plants produce more flowers. To test this, he planted two plants of the same size in separate containers with the same amount of potting soil. He then placed one plant in a sunny window and watered it every day with fertilized water and he placed the other plant on a shelf in a closet and watered it with plain water every other day.

Will this experiment help Jeremy answer the question of whether the fertilizer help produce more flowers? If you answered “yes,” then identify the independent, dependent, and controlled variables. If you answered “no,” then what advice would you offer Jeremy to improve his experimental design. Explain.
9.) *Snack Crackers*
Dr. Doofenshmirtz is not the smartest evil villain in the Tri-state area, but he believes he can improve his brain power by eating his new snack crackers called *Cheesy Brain Enlargenators*. In order to test this hypothesis, he recruits several of his evil friends to help him with an experiment. He created an intelligence test and gave it to his evil friends at the beginning of the experiment and then his evil friends ate one snack with each meal every day for three weeks. Afterwards, they took the test again. Analyze the data in the chart. Based on the data, did the *Cheesy Brain Enlargenator* snack crackers help his evil friends become smarter? Explain your answer.

<table>
<thead>
<tr>
<th>Friend</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hans</td>
<td>64%</td>
<td>80%</td>
</tr>
<tr>
<td>Rolf</td>
<td>78%</td>
<td>78%</td>
</tr>
<tr>
<td>Fritz</td>
<td>82%</td>
<td>84%</td>
</tr>
<tr>
<td>Dieter</td>
<td>72%</td>
<td>70%</td>
</tr>
</tbody>
</table>

10.) *Mega-Bubble*
Phineas and Ferb know what they are going to do today. They are going to compete in the Danville Mega-Bubble Contest. In order to win, they need to know which bubble gum will make the biggest bubbles. To prepare for the contest, they purchased five different brands of bubble gum. They need your help to decide which brand to use during the contest. Write an experiment to test the bubble size of the five bubble gum brands so they can win the contest. Where’s Perry?
The engineering design process is a series of steps that engineering teams use to guide them as they solve problems. Anyone can do it! To determine how to build something (skyscraper, amusement park ride, bicycle, music player), engineers gather information and conduct research to understand the needs of the challenge to be addressed. Then they brainstorm many imaginative possible solutions. They select the most promising idea and embark upon a design that includes drawings, and analytical decisions on the materials and construction, manufacturing and fabrication technologies to use. They create and test many prototypes, making improvements until the product design is good enough to meet their needs.

Engineers design and build all types of structures, systems and products that are important in our everyday lives. The engineering design process is a series of steps that engineering teams use to guide them as they solve problems:

- **Understand the need**: What is the problem? What do we want to accomplish? What are the project requirements? What are the limitations? Who is the customer? What is our goal? Gather information and conduct research - talking to people from many different backgrounds.
- **Brainstorm different designs**: Imagine and brainstorm ideas. Be creative; build upon the wild and crazy ideas of others. Investigate existing technologies and methods to use. Explore, compare and analyze many possible solutions.
- **Select a design**: Based on the needs identified, select the most promising idea.
- **Plan**: Draw a diagram of your idea. How will it work? What environmental and cultural considerations will you evaluate? What materials and tools are needed? What analyses must you do? How will you test it to make sure it works?
- **Create**: Assign team tasks. Build a prototype and test it against your design objectives. Push yourself for creativity, imagination and excellence in design. Does it work? Analyze and talk about what works, what doesn’t and what could be improved.
- **Improve**: Discuss how you could improve your product. Make revisions. Draw new designs. Iterate your design to make your product the best it can be.

Engineers use their science and math knowledge to explore all possible options and compare many design ideas. This is called open-ended design because when you start to solve a problem, you don’t know what the best solution will be to meet the requirements. The process is cyclical and may begin at, and return to, any step.

The use of prototypes, or early versions of the design (or a mock-up) helps move the design process forward by improving your team’s understanding of the problem, identifying missing requirements, evaluating design objectives and product features, and getting feedback from others.

Engineers select the solution that best uses the available resources and best meets the project’s requirements. They consider many factors before they implement a design: Cost to make and use, quality, reliability, environmental consideration, safety, functionality, ease of use, aesthetics, ethics, social and cultural impact, maintainability, testability, ease/cost of construction and manufacturability. They also consider sustainability - how the development, use and ultimate disposal of the product might impact people and our planet.
11.) NASA Scientists are currently planning for a manned landing on the planet Mars. One device that would be useful to the astronauts that travel to Mars would be a device that takes waste water and purifies it so the astronauts can reuse it. Using the engineering process described on the previous page, describe the process the engineers might use to develop this piece of equipment. Use complete sentences, and your imagination!
In Honors Physics, good measuring techniques will be required in order to be successful in lab activities. Obtaining accurate and precise data through measurement is a critical skill to learn, develop, and refine. There are a wide variety of physical quantities which can be measured, but there are only seven fundamental measures. A fundamental measure is a measurement that is not based on any other unit of measure. For example, speed is not a fundamental measure because it is based on distance and time (think miles per hour). Units of measure that are based on other measures are called derived units.

Do a little research and find the name, unit, and definition of the seven fundamental measures. Record your answers in the chart below:

<table>
<thead>
<tr>
<th>Name</th>
<th>Unit</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The International System of Units – the Metric System – is usually referred to as the SI. The metric system is used by scientists throughout the world, and is based on units of ten. Each unit is ten times larger or ten times smaller than the next unit, and these units are specified by the use of prefixes.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Unit</th>
<th>Quantity</th>
<th>Prefix</th>
<th>Symbol</th>
<th>Multi. Factor</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>Kelvin</td>
<td>Absolute temperature</td>
<td>Exa</td>
<td>E</td>
<td>10^{18}</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Hectare</td>
<td>Area</td>
<td>Peta</td>
<td>P</td>
<td>10^{15}</td>
<td></td>
</tr>
<tr>
<td>°C</td>
<td>Degree Celsius</td>
<td>Celsius temperature</td>
<td>Tera</td>
<td>T</td>
<td>10^{12}</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Coulomb</td>
<td>Electric charge</td>
<td>Giga</td>
<td>G</td>
<td>10^{9}</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Ampere</td>
<td>Electric current</td>
<td>Mega</td>
<td>M</td>
<td>10^{6}</td>
<td>10^6 m = 1 Mm</td>
</tr>
<tr>
<td>V</td>
<td>Volt</td>
<td>Electric potential energy</td>
<td>Kilo</td>
<td>k</td>
<td>10^{3}</td>
<td>10^3 g = 1 kg</td>
</tr>
<tr>
<td>Ω</td>
<td>Ohm</td>
<td>Electric resistance</td>
<td>Deci</td>
<td>d</td>
<td>10^{1}</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>Joule</td>
<td>Energy, work</td>
<td>Centi</td>
<td>c</td>
<td>10^{2}</td>
<td>10^{-2} m = 1 cm</td>
</tr>
<tr>
<td>N</td>
<td>Newton</td>
<td>Force</td>
<td>Milli</td>
<td>m</td>
<td>10^{3}</td>
<td>10^{-3} m = 1 mm</td>
</tr>
<tr>
<td>Hz</td>
<td>Hertz</td>
<td>Frequency</td>
<td>Micro</td>
<td>μ</td>
<td>10^{6}</td>
<td>10^{-6} m = 1 μm</td>
</tr>
<tr>
<td>m</td>
<td>Metre (meter)</td>
<td>Length</td>
<td>Nano</td>
<td>n</td>
<td>10^{9}</td>
<td></td>
</tr>
<tr>
<td>g</td>
<td>Gram</td>
<td>Mass</td>
<td>Pico</td>
<td>p</td>
<td>10^{12}</td>
<td></td>
</tr>
<tr>
<td>t</td>
<td>Tonne, metric ton</td>
<td>Mass</td>
<td>Femto</td>
<td>f</td>
<td>10^{15}</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>Watt</td>
<td>Power</td>
<td>Attos</td>
<td>a</td>
<td>10^{-18}</td>
<td></td>
</tr>
<tr>
<td>Pa</td>
<td>Pascal</td>
<td>Pressure, stress</td>
<td>a</td>
<td>Year</td>
<td>Time</td>
<td></td>
</tr>
<tr>
<td>s</td>
<td>Second</td>
<td>Time</td>
<td>d</td>
<td>Day</td>
<td>Time</td>
<td></td>
</tr>
<tr>
<td>h</td>
<td>Hour</td>
<td>Time</td>
<td>min</td>
<td>Minute</td>
<td>Time</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>Litre</td>
<td>Volume</td>
<td>s</td>
<td>Second</td>
<td>Time</td>
<td></td>
</tr>
</tbody>
</table>

Some commonly used Metric Units

**Length:** the distance from one point to another
- Meter (m): A meter is slightly longer than a yard
  - 1 m = 1000 mm
  - 1 m = 100 cm

**Mass:** the amount of mass in an object
- Gram (g): A paper clip has a mass close to a gram
  - 1000 g = 1 kg

**Volume:** the amount of space taken up by an object
- Liter (L): A meter is slightly longer than a quart
  - 1 L = 1000 mL

**Temperature:** the measure of energy in an object
- Celsius (°C): 0 °C freezing point of water
- Kelvin (°K): 100 °C boiling point of water
- -273 °C = 0 °K lowest temp possible

---

20. Which metric prefix means 1/100?
21. What does milli- mean?
22. If your mass is 73 kg, what is your mass in grams?
23. How many millimeters are there in a meter?
24. How many millimeters are there in a kilometer?
Using the abbreviations for the base units on the previous page, write abbreviations for the following metric units:

<table>
<thead>
<tr>
<th>23</th>
<th>Milligram</th>
<th>28</th>
<th>Kilogram</th>
<th>31</th>
<th>Micrometer</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Centimeter</td>
<td>29</td>
<td>Centigram</td>
<td>32</td>
<td>Millimeter</td>
</tr>
<tr>
<td>27</td>
<td>Kilometer</td>
<td>30</td>
<td>Decimeter</td>
<td>33</td>
<td>Megagram</td>
</tr>
</tbody>
</table>

Write the name for each metric unit abbreviated below:

<table>
<thead>
<tr>
<th>34</th>
<th>mm</th>
<th>37</th>
<th>km</th>
<th>40</th>
<th>mL</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>cg</td>
<td>38</td>
<td>cm</td>
<td>41</td>
<td>Mm</td>
</tr>
<tr>
<td>36</td>
<td>kg</td>
<td>39</td>
<td>dg</td>
<td>42</td>
<td>μm</td>
</tr>
</tbody>
</table>

Calculate the equivalence between the metric units:

<table>
<thead>
<tr>
<th>43</th>
<th>1 g =</th>
<th>48</th>
<th>1 m =</th>
<th>53</th>
<th>1 L =</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>1 m =</td>
<td>49</td>
<td>1 kg =</td>
<td>54</td>
<td>1 km =</td>
</tr>
<tr>
<td>45</td>
<td>1 m =</td>
<td>50</td>
<td>1 g =</td>
<td>55</td>
<td>1 cm =</td>
</tr>
<tr>
<td>46</td>
<td>1 cg =</td>
<td>51</td>
<td>1 mL =</td>
<td>56</td>
<td>1 dg =</td>
</tr>
<tr>
<td>47</td>
<td>1 kg =</td>
<td>52</td>
<td>1 cm =</td>
<td>57</td>
<td>1 Mm =</td>
</tr>
</tbody>
</table>

Calculate the equivalence between the units:

<table>
<thead>
<tr>
<th>58</th>
<th>268 mg =</th>
<th>61</th>
<th>6 in. =</th>
<th>64</th>
<th>0.00015 g =</th>
</tr>
</thead>
<tbody>
<tr>
<td>59</td>
<td>500 Ω =</td>
<td>62</td>
<td>0.025 m =</td>
<td>65</td>
<td>36 km =</td>
</tr>
<tr>
<td>60</td>
<td>247 km =</td>
<td>63</td>
<td>100 EV =</td>
<td>66</td>
<td>0.05 km =</td>
</tr>
</tbody>
</table>

What metric unit of measurement would you use to measure the following quantities?

<table>
<thead>
<tr>
<th>67</th>
<th>The amount of juice you drank at breakfast.</th>
<th>74</th>
<th>The amount of salt you put on your French fries.</th>
</tr>
</thead>
<tbody>
<tr>
<td>68</td>
<td>The amount of water you used in the shower this morning.</td>
<td>75</td>
<td>The amount of water your family uses in one year</td>
</tr>
<tr>
<td>69</td>
<td>The distance from here to Las Vegas, Nevada.</td>
<td>76</td>
<td>The distance from here to the moon.</td>
</tr>
<tr>
<td>70</td>
<td>The amount of energy in a liter of gasoline.</td>
<td>77</td>
<td>The amount of farmland on a wheat farm.</td>
</tr>
<tr>
<td>71</td>
<td>The thickness of a piece of notebook paper.</td>
<td>78</td>
<td>The width of a piece of paper.</td>
</tr>
<tr>
<td>72</td>
<td>The frequency of WEBN's radio signal.</td>
<td>79</td>
<td>The temperature on Pluto.</td>
</tr>
<tr>
<td>73</td>
<td>The mass of a skateboard.</td>
<td>80</td>
<td>The mass of the Earth.</td>
</tr>
</tbody>
</table>
it should be no surprise to you that in science a number with units represents some physical quantity. But did you know that it also says something about the measurement process that produced it? For example, suppose Jill and Fred are dancing together at the Homecoming dance, and the distance between them is determined to be about 30 cm. It would be fair to say that the precision of the measured distance between them is on the order of tens of centimeters. In other words, no attempt was made to measure the distance between Jill and Fred down to the nearest micron. In fact, for reasons discussed below, it probably wouldn’t make sense even to try.

So what would you think if someone told you that he had determined that the distance between Jill and Fred was actually 28.0026911014723 cm? That should set off red flags in your head. The inclusion of so many significant digits in this number implies that it is precise to within about 10^{-15} meters—the approximate size of a proton! I can immediately think of three big reasons why this is not likely to be the case.

A. It would be extremely difficult to measure distances on this scale without some very specialized tools. It’s pretty hard to imagine someone trying to measure Jill and Fred with an electron tunneling microscope or a laser interferometer out on the dance floor, but it sure is fun to try!

B. How does one determine endpoints for such a measurement? The thickness of a person can easily be 10 cm. Keeping this in mind, it really doesn’t make sense to try and measure the distance between Jill and Fred to any accuracy better than tenths of meters. If you wanted to be really careful, you could define a person’s position to be at their center of mass. If you had a way of determining where that was, you could start talking about more precise measurements of the distance between Jill and Fred.

C. Even with precise endpoints for your measurement, it still would not be practical to try and measure the distance between Jill and Fred to the nearest femtometer. Even the slightest breath of air on either of their parts would probably change the result of the measurement by a distance on the order of a millimeter. (That’s a trillion femtometers!) And even if you could convince them to stop breathing, you’d still have their pulses to deal with. With Jill and Fred dancing, you can bet that the distance between their center of masses is always changing on a scale even bigger than that.

Do a little research and find the rules for counting significant figures. Write them in the space below:
In our honors physics course, most of the numbers we use will have three significant digits. So, before you start the course, it is a good idea to make sure you know how to round numbers correctly to three significant digits. You probably think it’s a snap, and in most cases it is, but there are two special cases that seem to confuse students.

A. For some reason, people tend to want to round a number like 6.999942 down. If we were rounding to five significant digits, then that would be the right thing to do (giving us 6.9999). But we want to round this number to three significant figures. The correct answer is 7.00, not 6.99. Make sure you understand why.

B. The second case involves what I like to call “hanging 5’s”. A hanging 5 shows up whenever the number you are trying to round is exactly halfway between two values you might choose to round it to. For example, if you’re rounding to three significant figures, then 69.35 has a hanging 5 (because it’s exactly halfway between 69.3 and 69.4), whereas 69.351 does not (because it’s closer to 69.4). In elementary school you probably learned that you should always round 5’s up. That’s one simple approach to rounding, but it probably isn’t the best from a statistical standpoint because it introduces a bias into your data. What does that mean? Essentially, it means that, on the average, you round up more than you round down. A better approach involves rounding hanging 5’s up half of the time, and down the other half of the time. In honors physics, we will accomplish this by rounding hanging 5’s such that the last significant digit of our rounded number is even. In other words, 69.35 would be rounded up to 69.4, but 69.25 would be rounded down to 69.2.

**How many significant figures do the following numbers have?**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>82</td>
<td>1234</td>
</tr>
<tr>
<td>83</td>
<td>0.023</td>
</tr>
<tr>
<td>84</td>
<td>890</td>
</tr>
<tr>
<td>85</td>
<td>91010</td>
</tr>
<tr>
<td>86</td>
<td>9010.0</td>
</tr>
<tr>
<td>87</td>
<td>1090.0010</td>
</tr>
<tr>
<td>88</td>
<td>0.00120</td>
</tr>
<tr>
<td>89</td>
<td>340000</td>
</tr>
<tr>
<td>90</td>
<td>0.00090</td>
</tr>
<tr>
<td>91</td>
<td>0.09010</td>
</tr>
</tbody>
</table>

**Round the following measurements to three significant figures.**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>92</td>
<td>0.003115</td>
</tr>
<tr>
<td>93</td>
<td>1020012</td>
</tr>
<tr>
<td>94</td>
<td>780.5</td>
</tr>
<tr>
<td>95</td>
<td>1699</td>
</tr>
<tr>
<td>96</td>
<td>918.010</td>
</tr>
<tr>
<td>97</td>
<td>0.0001554</td>
</tr>
<tr>
<td>98</td>
<td>8125</td>
</tr>
<tr>
<td>99</td>
<td>0.00065979</td>
</tr>
<tr>
<td>100</td>
<td>0.003908</td>
</tr>
<tr>
<td>101</td>
<td>72.0015</td>
</tr>
</tbody>
</table>
In both scientific and engineering work, it is very common to have to work with extremely large or extremely small numbers. For example, the Sun has a mass of \(1,988,000,000,000,000,000,000,000,000,000\) kg. When scientists and engineers are plotting the path of a spacecraft traveling to another planet, the gravity of the sun must be taken into account and calculations involving the sun’s mass must be done. It would be very inconvenient to have to write that extremely long number. Similarly, a scientist might need to complete a calculation involving the mass of a proton, which is \(0.000000000000000000001672621636\) kg. It would be miserable to have to write that number when doing calculations. Instead, scientists and engineers take advantage of the powers of 10 and write the numbers more concisely.

For example, the mass of the sun is equal to \(1,988 \times 1,000,000,000,000,000,000,000,000,000\) (which is \(10^{27}\)). So the mass could be written as \(1,988 \times 10^{27}\) kg. However, scientists have agreed to make the first number in this “shortcut” a number bigger than or equal to 1 and less than 10. So the 1,988 would be converted to \(1.988 \times 1000\) making the mass of the sun \(1.988 \times 10^{10}\) kg. This shortcut way of writing numbers is called **scientific notation**.

127. How would you write the mass of a proton in scientific notation? 

The rules for converting numbers between standard notation and scientific notation are summarized here:

<table>
<thead>
<tr>
<th>Standard Notation \rightarrow Scientific Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Move the decimal in the original number to the right of the first nonzero digit to obtain a number (\geq 1) and (&lt; 10).</td>
</tr>
<tr>
<td>2. Count the number of places moved to determine the exponent.</td>
</tr>
<tr>
<td>a. Original number (10) or (&gt; 10) - positive exponent</td>
</tr>
<tr>
<td>b. Original number (&lt; 1) - negative exponent</td>
</tr>
<tr>
<td>3. Multiply the number obtained in step 1 by (10) to the power (exponent) found in step 2.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scientific Notation \rightarrow Standard Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Positive exponent</strong> - move the decimal to the right the same number of places as the exponent and drop the power of (10).</td>
</tr>
<tr>
<td>2. <strong>Negative exponent</strong> - move the decimal to the left the same number of places as the exponent and drop the power of (10).</td>
</tr>
</tbody>
</table>
Directions: *Indicate whether the sentence or statement is true or false. If a question is false, write the correct answer to make the statement true.*

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>128</td>
<td>$10^4$ is the same as 10,000.</td>
<td>T</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>129</td>
<td>$10^1$ is the same as 100.</td>
<td>T</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>130</td>
<td>$10^0$ is the same as 1.</td>
<td>T</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>131</td>
<td>$10^{-3}$ is the same as 0.00001</td>
<td>T</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>132</td>
<td>$10^{-2}$ is the same as 0.02.</td>
<td>T</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>133</td>
<td>The long form of 500,000 is equal to the scientific notation $5 \times 10^5$.</td>
<td>T</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>134</td>
<td>The long form of 0.0089 is equal to the scientific notation $8.9 \times 10^{-3}$.</td>
<td>T</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>135</td>
<td>The long form of 23.76 is equal to the scientific notation $2.376 \times 10^1$.</td>
<td>T</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>136</td>
<td>The long form of 1.386 is equal to the scientific notation $1.386 \times 10^1$.</td>
<td>T</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>137</td>
<td>The long form of 0.0084 is equal to the scientific notation $8.4 \times 10^{-2}$.</td>
<td>T</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>138</td>
<td>The scientific notation $2.376 \times 10^3$ is equal to the long form of 2,376,000.</td>
<td>T</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>139</td>
<td>The scientific notation $7.844 \times 10^6$ is equal to the long form of 78,440,000.</td>
<td>T</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>140</td>
<td>The scientific notation $4.95 \times 10^3$ is equal to the long form of 0.000495.</td>
<td>T</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>141</td>
<td>The scientific notation $3.9 \times 10^3$ is equal to the long form of 390,000.</td>
<td>T</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>142</td>
<td>The scientific notation $2.894452 \times 10^3$ is equal to the long form of 289,445.2.</td>
<td>T</td>
<td>F</td>
<td></td>
</tr>
</tbody>
</table>

---

**Write these numbers in scientific notation**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>143</td>
<td>1,230,000</td>
</tr>
<tr>
<td>144</td>
<td>0.00237</td>
</tr>
<tr>
<td>145</td>
<td>4,267,000,000,000</td>
</tr>
<tr>
<td>146</td>
<td>0.0000000068877</td>
</tr>
<tr>
<td>147</td>
<td>6,700,100,000,000</td>
</tr>
</tbody>
</table>

**Write these numbers in standard notation.**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>148</td>
<td>$1.57 \times 10^7$</td>
</tr>
<tr>
<td>149</td>
<td>$6.32 \times 10^4$</td>
</tr>
<tr>
<td>150</td>
<td>$7.2 \times 10^3$</td>
</tr>
<tr>
<td>151</td>
<td>$3 \times 10^6$</td>
</tr>
<tr>
<td>152</td>
<td>$9.7361 \times 10^5$</td>
</tr>
</tbody>
</table>
Graphing Activities
This lab was created by Mr. Buckley from Edward Knox High School. Credit is given for this original activity to Mr. Buckley.

Introduction

Graphing is used by scientists to display the data that is collected during a controlled experiment. A line graph must be constructed to accurately depict the data collected. An incorrect graph often leads to the acceptance of an incorrect hypothesis or detract from the acceptance of a correct hypothesis.

The graph should contain 5 major parts: the title, the independent variable, the dependent variable, the scales for each variable, and a legend.

1.) **The title:** this shows what the graph is about. Reading the title should give the reader an idea about the graph. It should be a concise statement placed above the graph.

2.) **The Independent Variable:** this is the variable (part of the experiment that changes) that can be controlled or manipulated by the experimenter. This variable should be placed on the horizontal or x-axis.

3.) **The Dependent Variable:** this is the variable directly affected by the independent variable. It is the result of what happens because of the independent variable. This variable is placed on the y or vertical axis.

4.) **The Scales for each Variable:** In constructing a graph, one needs to know where to plot the points representing the data. In order to do this a scale must be employed that will include all the data points. Each block should have a consistent amount or increment on a particular axis. While the scale should allow as much of the graph to be taken up as possible, it is not a good idea to set up a scale that is hard to manage. For example, multiples of 5, 10, etc. are good, while multiples such as 1.22 are not! Your scale must be plotted on the amount of graph space available, and will be dictated by the data points.

5.) **The Legend:** this is a short descriptive narrative concerning the graph's data. It should be short and to the point and placed directly under the graph.

Graphing Activity # 1

1. Use the data in the table below to complete the graph provided. Remember to title your graph, label the axes properly when setting up your scale, make a key, and to write a legend for your graph when completed.

<table>
<thead>
<tr>
<th>Depth in meters</th>
<th>Number of bubbles/min Plant A</th>
<th>Number of Bubbles/min Plant B</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>29</td>
<td>21</td>
</tr>
<tr>
<td>5</td>
<td>36</td>
<td>27</td>
</tr>
<tr>
<td>10</td>
<td>45</td>
<td>40</td>
</tr>
<tr>
<td>16</td>
<td>32</td>
<td>50</td>
</tr>
<tr>
<td>25</td>
<td>20</td>
<td>34</td>
</tr>
<tr>
<td>30</td>
<td>10</td>
<td>20</td>
</tr>
</tbody>
</table>
Answer the following questions based on the graph above you just completed.

1. What is the independent variable? ______________________________________________________

2. Why is this the independent variable? __________________________________________________
   ______________________________________________

3. What is the dependent variable? _______________________________________________________

4. Why is this the dependent variable? ___________________________________________________
   ______________________________________________
   ______________________________________________

5. Use one or more complete sentences to state a conclusion about the data in graph #
   __________________________________________________
   __________________________________________________
   __________________________________________________
   __________________________________________________
   __________________________________________________
Graphing Activity # 2

Diabetes is a disease affecting the insulin producing glands of the pancreas. If there is not enough insulin being produced by the cells, the amount of glucose in the blood will remain high. A blood glucose level above 140 for an extended period of time is not considered normal. This disease, if not brought under control, will lead to severe complications and even death.

1. Use the data in the table below to complete the graph provided. Remember to title your graph, label the axes properly when setting up your scale, make a key, and to write a legend for your graph when completed.

<table>
<thead>
<tr>
<th>Time After Eating (hrs.)</th>
<th>Glucose Level in ml/liter of blood in person A</th>
<th>Glucose Level in ml/liter of blood in person B</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>170</td>
<td>180</td>
</tr>
<tr>
<td>1</td>
<td>155</td>
<td>195</td>
</tr>
<tr>
<td>1.5</td>
<td>140</td>
<td>230</td>
</tr>
<tr>
<td>2</td>
<td>135</td>
<td>245</td>
</tr>
<tr>
<td>2.5</td>
<td>140</td>
<td>235</td>
</tr>
<tr>
<td>3</td>
<td>135</td>
<td>225</td>
</tr>
<tr>
<td>4</td>
<td>130</td>
<td>200</td>
</tr>
</tbody>
</table>
Answer the following questions based on the graph above you just completed.

1. What is the independent variable? _____________________________________________________
2. Why is this the independent variable? __________________________________________________
3. What is the dependent variable? ______________________________________________________
4. Why is this the dependent variable? _____________________________________________________
5. Which, if any of the above individuals has diabetes? Be sure to justify your answer!

6. If the time period were extended to 6 hours, what would be the expected blood sugar level for Person B? _________
7. What would be a probable blood sugar level for person B at 3.5 hours? _________
8. Use one or more complete sentences to state a conclusion about the data in graph # 2
Graphing Activity #3
The data table shows water temperatures at various depths in an ocean.

<table>
<thead>
<tr>
<th>Water Depth (meters)</th>
<th>Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>18</td>
</tr>
<tr>
<td>75</td>
<td>15</td>
</tr>
<tr>
<td>100</td>
<td>12</td>
</tr>
<tr>
<td>150</td>
<td>5</td>
</tr>
<tr>
<td>200</td>
<td>4</td>
</tr>
</tbody>
</table>

Using the information in the data table, construct a line graph on the grid, following the directions below:
-- Create a title for the graph. Write the title at the top of the graph.
-- Mark an appropriate scale on the axis labeled "Water Depth (m)."
-- Plot the data on the grid. Surround each point with a small circle and connect the points.

Example:
Problems Based on Graphing Set One

1. Using a complete sentence, state the general relationship between temperature and water depth.
Example: As the water depth increases/decreases, the temperature increases/decreases.

2. The approximate water temperature at a depth of 125 meters would be closest to:
   (1) 15°C   (2) 8°C   (3) 13°C   (4) 3°C

A student counted the total number of leaves in a group of duckweed plants over a 5-day period. The data collected are shown in the table below.

<table>
<thead>
<tr>
<th>Time in Days</th>
<th>Number of Leaves</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>40</td>
</tr>
<tr>
<td>4</td>
<td>60</td>
</tr>
<tr>
<td>5</td>
<td>80</td>
</tr>
</tbody>
</table>
Using the information in the data table, construct a line graph on the grid provided following the directions below.

-- Mark an appropriate scale on each labeled axis.
-- Plot the data from the data table. Surround each point with a small circle and connect the points.

Example:

Problems Based on Graphing Set Two

1. The time it takes for the number of leaves to increase from 15 to 30 is approximately
   (1) 2.0 days  (2) 2.3 days  (3) 2.9 days  (4) 3.2 days

2. Using a complete sentence, state what would most likely happen to the production of oxygen
   by duckweed plants if the intensity and duration of exposure to light were increased.

____________________________________________________________________________________
____________________________________________________________________________________
THE CHEMISTRY OF LIFE

1. Define organic.

2. All living things are made up of 6 essential elements: SPONCH. Name the six elements of life.
   - S –
   - P –
   - O –
   - N –
   - C –
   - H –

3. Elements join together by chemical bonds to form compounds. Name the 3 types of chemical bonds.

4. There are 4 major categories of organic molecules that are made up of the SPONCH elements. Complete the following chart on the macromolecules of life.

<table>
<thead>
<tr>
<th>LIPIDS</th>
<th>CARBOHYDRATES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Elements:</strong></td>
<td><strong>Elements:</strong></td>
</tr>
<tr>
<td><strong>Structure:</strong></td>
<td><strong>Structure:</strong></td>
</tr>
<tr>
<td><strong>Function:</strong></td>
<td><strong>Function:</strong></td>
</tr>
<tr>
<td><strong>Examples:</strong></td>
<td><strong>Examples:</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROTEINS</th>
<th>NUCLEIC ACIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Elements:</strong></td>
<td><strong>Elements:</strong></td>
</tr>
<tr>
<td><strong>Structure:</strong></td>
<td><strong>Structure:</strong></td>
</tr>
<tr>
<td><strong>Function:</strong></td>
<td><strong>Function:</strong></td>
</tr>
<tr>
<td><strong>Examples:</strong></td>
<td><strong>Examples:</strong></td>
</tr>
</tbody>
</table>
5. Define chemical reaction

6. Write an example of a chemical reaction and label the reactants and products.

7. Define activation energy.

8. Define enzyme.

9. How does an enzyme affect the activation energy for a chemical reaction?

10. **Any factors that affect the shape of an enzyme affect the enzyme’s activity.** What effect does pH and temperature have on an enzymes ability to catalyze (speed up) a reaction?
CELL BIOLOGY

1. Draw a plant and animal cell and label the following parts:

- Cell (plasma)
- membrane
- nuclear envelope
- nucleus
- nucleolus
- cytoplasm
- mitochondria
- endoplasmic reticulum
- golgi apparatus
- lysosome
- ribosome
- vacuole
- cell wall
- chloroplast
- cytoskeleton
- centriole

Plant Cell

Animal Cell
2. Complete the table below

<table>
<thead>
<tr>
<th>Cell Part</th>
<th>Function (job)</th>
<th>Plant, Animal or Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasma Membrane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuclear envelope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nucleus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nucleolus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cytoplasm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitochondria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endoplasmic reticulum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Golgi apparatus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lysosome</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ribosome</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vacuole</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cell wall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chloroplast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cytoskeleton</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centriole</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Explain the differences between a prokaryote and a eukaryote. Give examples of each.

4. Draw the structure of the cell membrane. What is it called?
5. Explain how diffusion, osmosis, and facilitated diffusion work. Be sure to know which way water flows across a membrane.
   - Diffusion
   - Osmosis –
   - Facilitated Diffusion –

6. What are the 6 kingdoms of life?

7. Identify which formula represents photosynthesis and which formula represents cellular respiration.
   \[ \text{Light} \quad 6\text{H}_2\text{O} + 6\text{CO}_2 \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \]
   \[ \text{energy} \quad \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{H}_2\text{O} + 6\text{CO}_2 + \text{energy} \]


9. Define cellular respiration.

10. How are photosynthesis and cellular respiration related?

11. Humans need oxygen to be able to perform cellular respiration and gain ATP energy for our cells. What would happen to the oxygen levels on Earth if photosynthesis stopped?

12. What happens when a phosphate group is removed from ATP? Is energy released or gained? Compare the energy levels of ATP, ADP, and AMP to the energy levels of a battery.
13. Draw and label the five phases of the cell cycle. What is the function of the cell cycle?

14. Compare and contrast mitosis and meiosis in terms of the steps and end products.

15. Describe fertilization using the terms haploid, gamete, diploid, and zygote.
1. What is DNA?

2. Draw and label the 3 parts of a nucleotide. How do nucleotides form the structure of DNA?

3. Draw a molecule of DNA. Label the following parts:
   - sugar/phosphate backbone
   - nucleotides
   - nitrogen bases
   - hydrogen bonds

4. What does the expression “double helix” mean?

5. What is the base-pairing rule?

6. What is the relationship between gene and DNA?

7. List the 3 steps of DNA replication using the following terms: dna helicase, replication fork, dna polymerase, base-pairing rule

8. Gene expression is the process of how genes in the DNA are turned into a phenotype that can be seen. Draw and label the 2 phases of gene expression. Describe where each happens in the cell.
9. Distinguish the end products of replication, transcription, and translation.

<table>
<thead>
<tr>
<th></th>
<th>Replication</th>
<th>Transcription</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. List 4 types of DNA mutations. Do all mutations result in a change in phenotype? Explain using the terms introns, exons, and codon.

11. What will happen if there is a mutation to the gametes?

12. Complete the following monohybrid cross. Two parents that are heterozygous for brown eyes. Be sure to identify the genotypes of the parents, complete the punnett square, identify the phenotypes with genotypes and the ratio of the phenotypes. What percent of the offspring have blue eyes?

13. Why do men experience male-pattern baldness more than women?

14. Using Mendel’s laws of segregation and independent assortment, explain why not all tall people have brown hair.

15. Describe an example for each of the following:

<table>
<thead>
<tr>
<th>Codominance</th>
<th>Polygenic Traits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete Dominance</td>
<td>Multiple</td>
</tr>
</tbody>
</table>
1. Describe the 4 levels of structural organization in the human body.

2. Complete the following chart for the major organ systems of the human body.

<table>
<thead>
<tr>
<th>Digestive System</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function</strong></td>
<td><strong>Path of Food (all major organs)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Circulatory System</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function</strong></td>
<td><strong>Path of Blood (all major organs)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Excretory System</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function of Kidneys</strong></td>
<td><strong>Function of Liver</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Respiratory System</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function</strong></td>
<td><strong>Path of Oxygen/Carbon Dioxide (all major organs)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nervous System</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function</strong></td>
<td><strong>Basic Unit – The Neuron How it works?</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Muscular/Skeletal System

<table>
<thead>
<tr>
<th>Function of Muscles</th>
<th>2 Functions of Bones</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Types of Muscle Tissue &amp; their Functions</td>
<td>2 Types of Connective Tissue &amp; How They Attach Muscle to Bone and Bone to Bone</td>
</tr>
</tbody>
</table>

3. Define homeostasis.

4. The organ systems of the human body work closely together to maintain the health of the entire body. An organism who cannot maintain homeostasis within all its systems will not live very long. Problem – It is cold out and you begin to shiver. Explain how the nervous system, muscular system, skeletal system, and circulatory system all work together to help you keep a constant body temperature.
1. What is evolution by natural selection?

2. Give an example of evolution by natural selection.

3. Describe evidence for evolution by filling in the chart below.

<table>
<thead>
<tr>
<th>Fossil Record</th>
<th>Comparative Anatomy</th>
<th>Genetic &amp; Molecular Similarities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Homologous Structures</td>
<td>Vestigial Structures</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Use an example to explain the steps of speciation (the formation of a new species).
   1.) Mutation –
   2.) Reproductive Isolation –
   3.) Natural Selection –
   4.) Divergence –
   5.) New Species

5. Define species.

6. What characteristics are organisms classified (grouped) by?
7. List the 8 levels of classification for all living things.

8. Binomial nomenclature is the system for scientifically naming organisms. Using an example, describe the rules for naming an organism.


10. How does evolution by natural selection affect the biodiversity of life on earth?
1. What is ecology?

2. What are the components of an ecosystem?

3. Define community.

4. Trace the flow of energy through the members of a community.

5. What does a food chain show? Give an example.

6. How do food chains relate to food webs?

7. Why are energy pyramids usually no more than 4 trophic levels?

8. Identify where the decomposers belong in the energy pyramid below. Explain their niche and why you placed them there.
9. Biogeochemical cycles are important to all ecosystems because they recycle all the important nutrients necessary for living things. Water, carbon, and nitrogen are essential for life. Describe how these materials are recycled in an ecosystem.

<table>
<thead>
<tr>
<th>Water Cycle</th>
<th>Carbon Cycle</th>
<th>Nitrogen Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiration</td>
<td>Photosynthesis</td>
<td>Denitrifying bacteria</td>
</tr>
<tr>
<td>Carbon in the form of carbon dioxide</td>
<td>Carbon in the form of food and living things</td>
<td>Nitrogen in the non usable form of nitrogen gas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nitrogen in the usable form of nitrates and ammonia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nitrogen-fixing bacteria</td>
</tr>
</tbody>
</table>

10. Biological communities are very complex due to the many interactions (symbiotic relationships) that happen between all organisms. Describe each of the following:

<table>
<thead>
<tr>
<th>Commensalism</th>
<th>Competition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parasitism</td>
<td>Mutualism</td>
</tr>
<tr>
<td>Predator/Prey</td>
<td></td>
</tr>
</tbody>
</table>

11. Define population.

12. Describe what factors can affect population size and biodiversity.