

ASFG HS Introduction to Statistics and Financial Math

Summer Assignment

PLEASE, THOROUGHLY, READ THE ENTIRE TEXT.

Get ready for an exciting year in Introduction to Statistics and Financial Math, where you'll discover how statistics and data can help you understand the world in powerful new ways. To ensure your success and make the most of this course, please complete the summer assignment. It's organized into 7 math sections and a science section, designed to be completed at a comfortable pace of one part per week.

1. [Part I - Mean, Median, Mode, and Range: Week 1 - June 23rd to 27th.](#)
2. [Part II - Solving Linear Equations and Inequalities: Week 2 - June 30th to June 4th.](#)
3. [Part III - Working with Formulas: Week 3 - July 7th to 11th.](#)
4. [Part IV - Formulas and Functions Evaluation: Week 4 - July 14th to 18th.](#)
5. [Part V - Exponential Growth and Decay: Week 5 - July 21st to 25th.](#)
6. [Part VI - Rates, Ratios & Percentages: Week 6 - July 20th to August 01st.](#)
7. [Part VII - Bar Graphs, Histograms, and Pie Charts: Week 7 - August 04th to 08th.](#)
8. Part VIII - Science Part (Based on Science Course Selection): Week 8 - August 11th to 15th.
9. [Answers](#)

You can tackle this assignment at your own pace; the suggested weekly breakdown is just a guideline.

This assignment won't be collected, but you **will be tested** on its content. A practice test will be provided at the start of the school year.

You're responsible for understanding how to solve every problem, but you don't need to complete all of them.

We recommend doing **every third problem** (e.g., 1, 4, 7, 10...) to manage your workload and review key topics. Solutions are at the end of the document.

Unless specified, do not use a calculator for these exercises, but you may use it to check your answers. Please show all your work neatly.

The best **go-to resource is Khan Academy**: if you have a question about a specific concept you can look for it within Khan Academy's search engine and you'll be given some theory and practice exercises to master such topic/skill.

Enjoy the summer and be happy, guys!

Sincerely,

The ASFG HS Math Department

Part I - Mean, Median, Mode, and Range: Week 1 - June 23rd to 27th.

General Instructions: Please complete all sections of this assignment to review key mathematical concepts from your previous math courses. Show all your work where applicable. [Answers](#) are found at the end of the document.

Specific instructions: For each dataset below, calculate the mean, median, mode (if one exists), and range. Round up to the nearest hundredth (when applicable) or tenth (when applicable). PLEASE, DO NOT USE A CALCULATOR.

1. Dataset 1: 12, 15, 18, 12, 16
2. Dataset 2: 25, 30, 35, 40, 25, 32
3. Dataset 3: 10, 20, 15, 25, 30
4. Dataset 4: The following are the scores of 10 students on a short quiz: 7, 8, 9, 7, 6, 10, 8, 8, 9, 7.
5. A small business recorded the number of customers they had each day for a week: Monday (22), Tuesday (28), Wednesday (25), Thursday (30), Friday (35). Calculate the average number of customers per day and the spread of the daily customer count.
6. Dataset 6: 8, 10, 12, 14, 16, 18
7. Dataset 7: 45, 52, 48, 55, 48, 60

8. Dataset 8: The daily high temperatures (in degrees Fahrenheit) for a week in a certain city were: 72, 75, 70, 78, 75, 80, 75.
9. A student scored 85, 92, 88, and 90 on their first four math tests. If they want their average score for all five tests to be exactly 90, what score do they need on the fifth test?
10. A survey asked students how many siblings they have. The results were:
- a. 0 siblings: 3 students
 - b. 1 sibling: 8 students
 - c. 2 siblings: 5 students
 - d. 3 siblings: 2 students
 - i. Calculate the mean number of siblings per student.
11. Two different branches of a clothing store reported their daily sales (in hundreds of dollars) for a week:
- a. Branch A: 12, 15, 11, 18, 14
 - b. Branch B: 10, 20, 13, 17, 15
 - i. Which branch had a higher average daily sales, and which branch had a greater spread in their daily sales? Justify your answers using the calculated measures.
12. Consider the dataset: 5, 6, 7, 8, 50.
- a. Calculate the mean, median, mode, and range for this dataset.
 - b. If the value 50 was removed from the dataset, how would the mean, median, and range change? Explain why these changes occur.

Part II - Solving Linear Equations and Inequalities: Week 2 - June 30th to June 4th.

General Instructions: Please complete all sections of this assignment to review key mathematical concepts from your previous math courses. Show all your work where applicable. [Answers](#) are found at the end of the document.

Specific instructions: Solve for the variable in each equation or inequality. PLEASE, DO NOT USE A CALCULATOR.

1. $x + 5 = 12$

2. $3y - 7 = 8$

3. $-2a + 9 = 3$

4. $4(z - 2) = 16$

5. Inequality: $2m + 3 < 9$. Sketch the solution on a number line.

6. $5(x - 3) + 2x = 4x + 9$

7. $2x - 21 = 6x + 35$

8. $7 - (4y - 1) = 3(y + 2) - 10$

9. $\frac{z-4}{5} + \frac{3}{10} = \frac{2z+1}{3}$

10. Solve the equation: $A = P + Prt$ for r .

11. Inequality: $5w - 1 \geq 3w + 7$. Sketch the solution on a number line.

12. A cell phone company charges a flat fee of \$25 per month plus \$0.05 per text message. If your bill for one month was \$32.50, how many text messages did you send?

Part III - Working with Formulas: Week 3 - July 7th to 11th.

General Instructions: Please complete all sections of this assignment to review key mathematical concepts from your previous math courses. Show all your work where applicable. [Answers](#) are found at the end of the document.

Specific instructions: Solve for the indicated variable in each formula. Then, use the given values to find the value of that variable. PLEASE, DO NOT USE A CALCULATOR.

1. Formula: $A = lw$, (Area of a rectangle).
 - a. Solve for w .

 - b. If $A = 48$ and $l = 8$, find w .

2. Formula: $P = 2l + 2w$, (Perimeter of a rectangle).
 - a. Solve for l .

 - b. If $P = 30$ and $w = 5$, find l .

3. Formula: $I = Prt$, (Simple Interest).
 - a. Solve for t .

 - b. If $I = 100$, $P = 500$, and $r = 0.05$, find t .

4. Formula: $C = \frac{5}{9}(F - 32)$, (Celsius to Fahrenheit conversion).
 - a. Solve for F .

 - b. If $C = 25$, find F .

5. The formula for the total cost C of producing n items is $C = 5n + 20$. If the total cost is \$120, how many items were produced?

6. Formula: $P = S - C$, (Profit = Sales - Cost).

a. Solve for S .

b. If $P = 1500$ and $C = 3000$, find S .

7. Formula: $D = \frac{m}{V}$, (Density = mass / Volume).

a. Solve for m .

b. If $D = 10 \frac{g}{cm^3}$ and $V = 25 cm^3$, find m .

8. Formula: $V = \frac{1}{3}Bh$, (Volume of a pyramid).

a. Solve for h .

b. If $V = 60$ cubic units and $B = 15$ square units, find h .

9. Equation: $ax + b = c$

a. Solve for x .

b. Then, if $a = 3$, $b = 7$, and $c = 19$, find x .

10. The formula for average speed is $s = \frac{d}{t}$. (speed = distance / time).

a. If a car traveled a distance of 240 miles at an average speed of 60 miles per hour, how long did the trip take?

11. Solve the equation $A = P(1 + rt)$ for P .

12. If the mean of 5 test scores is 88, and four of the scores are 85, 90, 82, and 95, what is the fifth score?

Part IV - Formulas and Functions Evaluation: Week 4 - July 14th to 18th.

General Instructions: Please complete all sections of this assignment to review key mathematical concepts from your previous math courses. Show all your work where applicable. [Answers](#) are found at the end of the document.

Specific instructions: Evaluate the following formulas and functions for the given values. BASIC CALCULATOR IS ALLOWED.

1. Given the formula: $d = rt$, (distance = rate $\times$ time), find d if $r = 65$ miles per hour and $t = 3$ hours.
2. Given the formula: $A = \pi r^2$, (area of a circle), find A if $r = 4$ cm. (Express your result in term of π).
3. Given the function: $f(x) = 2x - 1$, find $f(4)$ and $f(-2)$.
4. Given the function: $g(t) = t^2 + 3t - 5$, find $g(0)$ and $g(-3)$.
5. The profit $P(x)$ from selling x items is given by the function $P(x) = 10x - 50$. Find the profit if 20 items are sold.
6. Given the formula, $A = P(1 + r)^t$, where A is the final amount, P is the principal investment, r is the annual interest rate (as a decimal), and t is the number of years.
 - a. Calculate A if $P = \$5000$, $r = 0.04$ (4%), and $t = 2$ years.

7. Given the formula, $FV = PMT \left(\frac{(1+i)^n - 1}{i} \right)$, where FV is the future value, PMT is the payment per period, i is the interest rate per period, and n is the number of periods.
- a. Calculate FV if $PMT = \$100$, $i = 0.01$ (1% per period), and $n = 3$ periods.

8. Given the formula for the distance d between two points (x_1, y_1) and (x_2, y_2) as:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$

- a. Find the distance between the points (1,2) and (5,5).

9. For a small dataset, the formula for standard deviation s can be simplified. Given the data points $x_1 = 2, x_2 = 4, x_3 = 6$ and their mean is $\bar{x} = 4$.

- a. Evaluate the following expression, which is part of the standard deviation calculation:

$$\sqrt{\frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + (x_3 - \bar{x})^2}{3}}$$

10. Evaluate the function $h(x)$ at the given values: $h(x) = \begin{cases} 3x+1 & \text{if } x < 0 \\ x^2 - 2 & \text{if } x \geq 0 \end{cases}$

- a. Find $h(-2)$.

- b. Find $h(3)$.

11. A company's production cost $C(m)$ for manufacturing m items is given by the function $C(m) = 15m + 250$.

- a. Calculate the cost of manufacturing 50 items.

- b. If the company wants to keep costs below \$5000, what is the maximum number of items they can manufacture? (You'll need to set up and solve an inequality here).

Part V - Exponential Growth and Decay: Week 5 - July 21st to 25th.

General Instructions: Please complete all sections of this assignment to review key mathematical concepts from your previous math courses. Show all your work where applicable. [Answers](#) are found at the end of the document.

Specific instructions: Solve the following problems involving exponential growth and decay. PLEASE, DO NOT USE A CALCULATOR.

1. Evaluate the expression $2^3 \times 2^2$.

2. Evaluate the expression $(3^4)^2$.

3. Solve for x : $3^{x+1} = 81$.

4. Solve for y : $4 * 2^y = 31$.

5. Evaluate the following logarithmic expression:

a. $\log_2 16$

b. $\log_{10} 100$

6. Convert between Logarithmic and Exponential form:

a. $5^3 = 125$

b. $\log_4 16 = 2$

7. A population of bacteria doubles every hour. If there are initially 50 bacteria, how many will there be after 3 hours?
8. A car depreciates in value by 10% per year. If the car was initially worth \$20,000, what will its value be after 2 years?
9. An investment grows at a rate of 5% per year. If you initially invest \$1000, how much will you have after 2 years? (Assume the interest is compounded annually, so the formula is $A(t) = P(1 + r)^t$).
10. A local newspaper's online readership has been growing exponentially, modeled by the equation $R(t) = 5000 \cdot (1.2)^t$, where $R(t)$ is the readership after t months. In how many months will the readership reach 7200?

Part VI - Rates, Ratios & Percentages: Week 6 - July 20th to August 01st.

General Instructions: Please complete all sections of this assignment to review key mathematical concepts from your previous math courses. Show all your work where applicable. [Answers](#) are found at the end of the document.

Specific instructions: Solve the following problems involving rates, ratios, and percentages. PLEASE, DO NOT USE A CALCULATOR.

1. Simplify the ratio 15:25.
2. If the ratio of boys to girls in a class is 3:4 and there are 12 boys, how many girls are there?
3. A recipe calls for 2 cups of flour for every 3 cups of sugar. If you want to make a larger batch using 6 cups of flour, how many cups of sugar will you need?
4. A car travels 150 miles in 3 hours. What is its average speed in miles per hour?
5. A store sells apples at a rate of \$2.50 per pound. How much would 3.5 pounds of apples cost?
6. What is 35% of 240?
7. In a class of 50 students, 18 prefer reading over other hobbies. What percentage of students prefer reading?

8. A television is on sale for 20% off. If the discount amount is \$75, what was the original price of the television before the discount?
9. A stock increased in value from \$50 to \$60. What is the percentage increase?
10. The number of customers at a coffee shop decreased from 200 to 180 in a week. What is the percentage decrease?
11. A pair of sneakers originally costs \$80. They are on sale for 25% off. After the discount, a 6% sales tax is added to the price. What is the final price of the sneakers?
12. After a 10% raise, an employee's new hourly wage is \$22. What was their hourly wage before the raise?
13. A family's monthly budget of \$4,500 is allocated as follows:
- a. Rent: 30%, Food: 25%, Transportation: 15%, Savings: 10%, Utilities & Other: Remaining percentage
 - i. How much money is allocated for Food each month?
 - ii. What percentage of the budget is allocated to "Utilities & Other"?
 - iii. Write the ratio of money spent on Rent to money spent on Transportation in simplest form.

Part VII - Bar Graphs, Histograms, and Pie Charts: Week 7 - August 04th to 08th.

General Instructions: Please complete all sections of this assignment to review key mathematical concepts from your previous math courses. Show all your work where applicable. [Answers](#) are found at the end of the document.

Specific instructions: Answer the questions based on the provided descriptions.

1. A bar graph shows the number of students who prefer different subjects: Math (50), Science (60), English (45), History (55).
 - a. In a very approximate and simple sketch, build the visual representation of the bar graph.
 - b. Which subject is the most popular?
2. A pie chart shows the distribution of expenses for a household: Rent (40%), Food (30%), Transportation (20%), Other (10%).
 - a. In a very approximate and simple sketch, build the visual representation of the pie chart.
 - b. If the total monthly expenses are \$3000, how much is spent on food?
3. A histogram shows the distribution of test scores. The bars represent the following score ranges: 60-69, 70-79, 80-89, 90-99. The heights of the bars are 5, 12, 8, and 3 respectively.
 - a. In a very approximate and simple sketch, build the visual representation of the histogram.
 - b. Which score range had the most students?
4. Interpretation: What type of data (categorical or numerical) is typically represented by a pie chart? Explain your reasoning.
5. Comparison: What is the main difference in the type of data typically displayed in a bar graph versus a histogram?

Answers

Part I - Mean, Median, Mode, and Range: Week 1 - June 23rd to 27th.

1. Mean: 14.6, Median: 15, Mode: 12, Range: 6.
2. Mean: 31.17, Median: 31, Mode: 25, Range: 15.
3. Mean: 20, Median: 20, Mode: DNE, Range: 20.
4. Mean: 7.9, Median: 8, Mode: 7 & 8, Range: 4.
5. Average customers per day: 28, Daily spread of customer: 13
6. Mean: 13, Median: 13, Mode: DNE, Range: 10.
7. Mean: 51.33, Median: 50, Mode: 48, Range: 15.
8. Mean: 75, Median: 75, Mode: 75, Range: 10.
9. Score must be a 95.
10. Average number of siblings per student: 1.33.
11. Higher average daily sales: Branch B with \$1,500 USD, Greater spread in daily sales: Branch B with \$1,000 USD.
12. Changing the dataset:
 - a. Original dataset:
 - i. Mean: 15.2, Median: 7, Mode: DNE, Range: 45.
 - b. 50 removed from dataset:
 - i. Mean: 6.5, Median: 6.5, Range: 3.
 - ii. Changes occur because of the presence of a very big number compared to the rest of the set, this is known as outlier presence.

Part II - Solving Linear Equations and Inequalities: Week 2 - June 30th to June 4th.

1. $x = 7$
2. $y = 15$
3. $a = 3$
4. $z = 6$
5. $m < 3$
6. $x = 8$
7. $x = -14$
8. $y = \frac{12}{7}$
9. $z = \frac{-25}{14}$
10. $r = \frac{\frac{A}{P}-1}{t}$
11. $w \geq 4$
12. $x = 150$

Part III - Working with Formulas: Week 3 - July 7th to 11th.

1. $w = \frac{A}{l}, w = 6$
2. $l = \frac{P-2w}{2}, l = 10$
3. $t = \frac{l}{Pr}, t = 4$
4. $F = \frac{9}{5}C + 32, F = 77$
5. $n = \frac{C-20}{5}, n = 20$
6. $S = P + C, S = 4500$
7. $m = D * v, m = 250g$

8. $h = \frac{3V}{B}, h = 12 \text{ units}$
9. $ax + b = c, x = 4$
10. 4 hours
11. $P = \frac{A}{1+rt}$
12. $x = 88$

Part IV - Formulas and Functions Evaluation: Week 4 - July 14th to 18th.

1. $d = 195 \text{ miles}$
2. $A = 16\pi \text{ cm}^2$
3. $f(4) = 7, f(-2) = -5$
4. $g(0) = -5, g(-3) = -5$
5. $P(20) = 150$
6. \$5408
7. $FV = \$303.01$
8. $d = 5$
9. 1.63
10. $h(-2) = -5, h(3) = 7$
11. $m < 316$

Part V - Exponential Growth and Decay: Week 5 - July 21st to 25th.

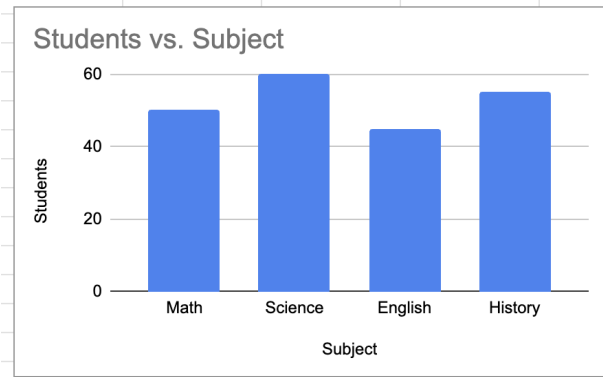
1. 32
2. 6561
3. $x = 3$
4. $y = \log_2\left(\frac{31}{4}\right)$
5. $\log_2(16) = 4, \log_{10}(100) = 2$
6. $3 = \log_5(125), 16 = 4^2$
7. 400 bacteria
8. \$16,200
9. \$1102.50
10. $t = 2 \text{ months}$

Part VI - Rates, Ratios & Percentages: Week 6 - July 20th to August 01st.

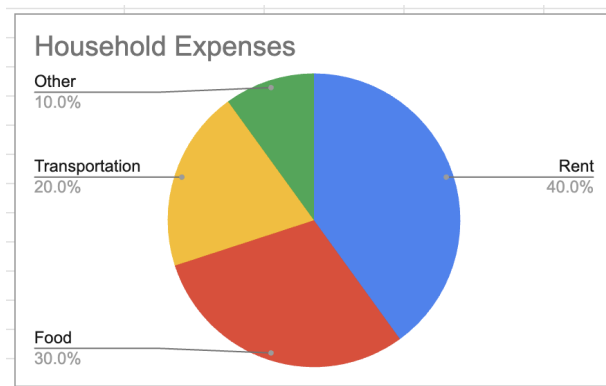
1. 3:5
2. 16 girls
3. 9 cups of sugar
4. $50 \frac{\text{mi}}{\text{h}}$
5. \$8.75
6. 84
7. 36%
8. \$93.75
9. 20%
10. 10% decrease
11. \$63.6
12. \$20
13. Money in food: \$1125, Money in Utilities & Others: \$900, Ratio is 2:1

Part VII - Bar Graphs, Histograms, and Pie Charts: Week 7 - August 04th to 08th.

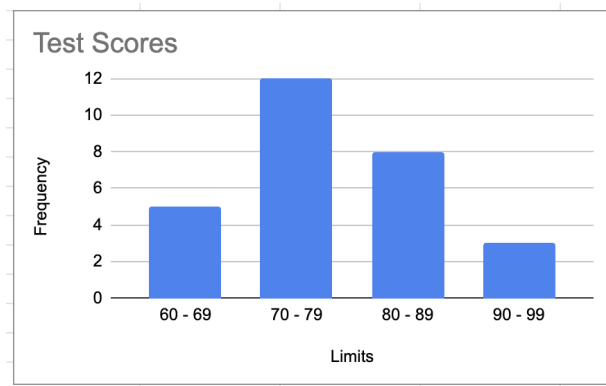
1. Most Popular Subject: Science



2. Food Expense: \$900



3. Range with Most Scores: 70 - 79 (Important Note: Histogram bars should be side by side each other)



4. **Categorical (Qualitative)** data is mostly represented. The reason behind it is that interpreting the share or piece a category takes under a specific context or scenario provides meaningful and deep understanding of data and its possible impact.
5. A bar graph is used to express and represent **categorical (qualitative)** data; it allows the objective visualization of how much there is of each thing. A histogram is used to express and represent **numerical (quantitative)** data; it allows the objective grouping of numbers under numerical categories.

Science Department Math Prerequisites

Addendum

Instructions: Identify which Science course you will take next school year and complete the corresponding exercises by hand (pencil and paper). **Always show all your work.**

Integrated Science / 9th

Powers of 10 & Scientific Notation:

1. How many zeros are in 10^6 ?
2. Write 10^5 as a whole number.
3. Write 10^{-3} as a decimal.
4. What is $1 \div 10^2$?
5. Which is larger: 10^4 or 10^6 ?
6. Which is smaller: 10^{-2} or 10^{-5} ?
7. Write 0.0001 in scientific notation.
8. Write 4,500,000 in scientific notation.
9. If a virus is 5×10^2 nm long and a microscope magnifies by 10^3 , how long will the virus appear?
10. If a cell is 2×10^5 nm wide and shrinks by a factor of 10^2 , how wide is it now?

Fractions (Division & Simplification):

11. A scientist has $\frac{3}{4}$ of a liter of liquid. How many 0.25 L portions can they make?
12. Simplify $\frac{8}{12}$ by canceling common factors.
13. A bacteria sample grows 50% of the sample every hour. If it starts at $\frac{3}{5}$ of a dish, how much of the dish will it cover in one hour?
14. A chemist has $\frac{3}{5}$ of a liter and needs to pour it into $\frac{1}{10}$ liter test tubes. How many test tubes can they fill?
15. Two solutions are mixed: $\frac{1}{4}$ L of one and $\frac{3}{8}$ L of another. What is the new total volume?
16. A reaction requires $\frac{7}{8}$ of a gram of a substance, but only $\frac{1}{2}$ gram is available. How much more is needed?
17. A microscope slide $\frac{2}{5}$ of a millimeter per second. How far does it move in 10 seconds? And in 1 minute?
18. Convert 0.333... into a fraction.

19. A star is 2×10^9 km away. If a spaceship travels $1/100$ of that distance, how far has it traveled?
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Biology / 10th - 11th

Scientific Notation and Powers of 10

1. A virus measures 2.5×10^{-8} meters. How many nanometers (nm) is this? ($1 \text{ nm} = 1 \times 10^{-9} \text{ m}$)
2. A bacterial colony grows from 1.2×10^6 to 9.6×10^6 cells. What is the difference in population size?
3. Multiply the number of cells in two bacterial cultures: 4.0×10^5 cells $\times$ 3.0×10^3 cells.
4. A DNA molecule is 2.0×10^{-9} m wide. How wide is 1000 molecules placed side-by-side?
5. Write the number of ribosomes in a cell as scientific notation: 8,400,000.

Dimensional Analysis

6. A population of bacteria increased from 2.5×10^3 to 1.0×10^4 in 2 hours. What is the percent change?
7. An enzyme reaction produces 120 mL of product in 3 minutes. What is the rate in mL per second?
8. A scientist measured the oxygen concentration in water as 8.0 mg/L, but after pollution, it dropped to 5.6 mg/L. What is the percent decrease?
9. A student's pulse rate changes from 72 bpm to 90 bpm during exercise. What is the percent increase?
10. A bacteria cell is 2×10^{-6} meters long. A paramecium is 2×10^{-4} meters long. How many times longer is the paramecium compared to the bacteria?
11. A virus is 50 nm long. A microscope magnifies the image by 4000 $\times$. How long will the virus appear under the microscope (in micrometers)?
12. A model of a pollen grain is built at a scale of 1:5000. If the real pollen grain is 30 micrometers across, how large is the model in centimeters?
13. The width of a human hair is about 80 micrometers. A red blood cell is about 8 micrometers across. How many times smaller is the red blood cell than the hair?

Probability & Frequency in Populations

14. In a population of 100 beetles, 35 are green. What is the probability of randomly selecting a green beetle?
15. If a trait appears in 25 out of 200 individuals, what is the frequency of the trait?
16. In a population of 120 plants, 30 have red flowers. What is the probability that two randomly selected plants both have red flowers (without replacement)?

Descriptive Statistics

17. The lengths of five leaves are: 4.2 cm, 3.8 cm, 4.0 cm, 4.5 cm, 4.0 cm. Find the mean, median, and mode.

Concentration

18. You dissolve 5 grams of salt in 100 mL of water. What is the concentration in g/mL?
19. A glucose solution contains 20 mg/mL. How many grams of glucose are in 2 liters?

Population Biology (Growth & Estimation)

20. A butterfly population grows from 200 to 280 in one week. What is the growth rate in individuals per day?
21. Use the formula $dN/dt = rN$. A bird population has 500 individuals in the year 2020 ($N = 500$). The maximum growth rate is $r = 0.1$ per year. Assuming continuous growth and no effect of the carrying capacity, what is the expected population size in 2023?
22. Using the Lincoln-Petersen Index ($R/S = M/N$). If 25 marked turtles are recaptured (R) out of a sample of 100 (S), and 50 turtles were originally marked (M), estimate the population size (N).
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Chemistry / 10th - 11th

Powers of ten: expand

- a) $10^5 = ?$
- b) $10^{-4} = ?$

Scientific notation

- a) Coulomb's Constant (k_e) is equal to $8.987551 \times 10^9 \text{ N} \cdot \text{m}^2 / \text{C}^2$. What is this number expressed in non-scientific (numerical) notation?
- b) Convert to Scientific Notation: $-0.00000516 =$
- c) If one donut has 1.95×10^2 calories and I consume 1.2×10^2 donuts every 5 years, how many calories will I have consumed from donuts after 25 years?

Algebraic operations

- a) $8x^2y(4x - 2y + 3) =$
- b) $(8x^3 - 4x^2)/2x =$
- c) If I have the equation: $9y = (12x/3y) + 3y$, what is the value of x ?

d) Solve $36/(2(3x + 4)) = -10/3x$

SI Units and conversions (factor label method)

- a) If my experiment calls for 500 mg of Sodium Chloride (NaCl), but my scale only measures in grams, how many grams of sodium chloride will I need to measure?
- b) Calculate the speed of light in Miles/hr in Sc. notation if a distance of 3000 km is traveled in 0.01 seconds. (1 Mile = 1.6km, 1hr = 60 min, 1 min = 60 sec)
-

Environmental Science / 12th - 11th

Factor Label Method:

1. A car emits 4.6 metric tons of CO₂ per year. Convert this to grams per year.
(1 metric ton = 1000 kg)
2. The average person in the U.S. uses 82 gallons of water per day. Convert this to liters per day.
(1 gallon = 3.8 liters)
3. The Amazon rainforest is being deforested at a rate of 10,000 km² per year. Convert this to m² per second.
(1 km² = 1,000,000 m²)
4. A wind turbine produces 2.5 MW per hour. Convert this to watts per second.
(1 MW = 1000 kW)
5. Approximately 1.5×10^6 metric tons of plastic enter the ocean annually. Convert this to grams per second.
(1 metric ton = 1×10^6 grams)

Scientific Notation

Addition & Subtraction

6. $3.2 \times 10^5 + 4.8 \times 10^4$
7. $6.5 \times 10^7 - 2.1 \times 10^{-24}$
8. $9.1 \times 10^{22} + 3.7 \times 10^6$
9. $5.0 \times 10^{-6} - 2.5 \times 10^{-5}$

Multiplication & Division

10. $4.2 \times 10^3 \times 2.5 \times 10^2$
11. $7.5 \times 10^{-4} \times 3.0 \times 10^{12}$

12. $8.4 \times 10^{11} / 2.1 \times 10^{-23}$

13. $6.3 \times 10^{-3} / 2.1 \times 10^{-5}$

Percent Change

14. The concentration of particulate matter ($PM_{2.5}$) in a city was $56 \mu\text{g}/\text{m}^3$ in 2010. Due to stricter regulations, the pollution level changed to $42 \mu\text{g}/\text{m}^3$ in 2023. What is the percent change in $PM_{2.5}$ concentration?
 15. A tropical rainforest had 8,000 hectares of forest in 2000. By 2020, the forest area changed to 10,400 hectares due to reforestation efforts. What is the percent change in forest area?
 16. A city generated 120 MW of electricity from solar panels in 2015. By 2023, the solar energy output changed to 180 MW. What is the percent change in solar energy production?
 17. A school implemented a water conservation program. Before the program, it used 250,000 liters of water per month. After six months, the usage changed to 200,000 liters. What is the percent change in water consumption?
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Physics/ 12th

Algebraic Manipulation

1. Calculate v_f in the equation: $v_f = v_i + at$ (Try your best to indicate the correct units for the answer) when $v_i = 5\text{m}/\text{s}$, $a = 2\text{m}/\text{s}^2$, and $t = 4\text{s}$.
2. The kinetic energy equation is $KE = 1/2mv^2$. Solve for v in terms of KE and m .
3. The force equation is $F = ma$. (Try your best to indicate the correct units for the answer). If an object has a mass of 8 kg and experiences a force of 40N, what is its acceleration?
4. The gravitational potential energy equation is $PE = mgh$. (Try your best to indicate the correct units for the answer). Solve for h when $PE = 980\text{ J}$, $m = 10\text{ kg}$, and $g = 9.8\text{ m}/\text{s}^2$.
5. The momentum equation is $p = mv$. Rearrange the equation to solve for m , then calculate the mass if $p = 120\frac{\text{kgm}}{\text{s}}$ and $v = 3\frac{\text{m}}{\text{s}}$.

Trigonometry & Vectors

6. A right triangle has a hypotenuse of **10 m** and an opposite side of **6 m**. Find the angle θ using sine.
7. A car moves **30 m** east and **40 m** north. Use the Pythagorean theorem to find the total displacement.
8. A force of **50 N** is applied at a **30°** angle above the horizontal. Find the horizontal component of the force using right triangle trigonometry.

9. A boat moves **10 m/s** across a river with a **4 m/s** current perpendicular to its motion. Use the Pythagorean theorem to find the boat's resultant velocity.
10. Determine the x and y components of a displacement whose magnitude is 30.0 m at a 23° angle from the x-axis.

Scientific Notation

11. Convert the following into scientific notation:
- a. 4500000
 - b. 0.00032
12. Express the speed of light ($3.8 \times 10^8 \text{ m/s}$) in standard notation.
13. Multiply (4.2×10^5) by (2.0×10^3). Express the answer in scientific notation.
14. Divide (6.0×10^{-6}) by (2.0×10^{-3}). Express the answer in scientific notation.
15. The mass of the Earth is about $5.97 \times 10^{24} \text{ kg}$, and the mass of a hydrogen atom is about $1.67 \times 10^{-27} \text{ kg}$. How many hydrogen atoms would it take to equal the mass of the Earth?