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MATH 101

Summer 2022

HW 3: Due 05/26

“Mathematics is not about numbers, equations, computations, or algorithms: it is about understanding.”

– William Paul Thurston

Problem 1. (10pt) Suppose a course grade consists of the following weights:

Homework	30%
Quizzes	15%
Exam 1	20%
Exam 2	20%
Final Exam	10%
Project	5%

Suppose also that a student had a 86% homework average, 90% quiz average, 72% on exam 1, 87% on exam 2, 95% on the final, and 82% on the project. Compute the student's course average.

Solution.

$$\begin{aligned}\text{Course Average} &= \sum \text{weight} \cdot \text{average} \\ &= 30(0.86) + 15(0.90) + 20(0.72) + 20(0.87) + 10(0.95) + 5(0.82) \\ &= 84.7\end{aligned}$$

Problem 2. (10pt) Suppose a GPA consists of the following weights:

A	4.0	C+	2.3
A−	3.7	C	2.0
B+	3.3	C−	1.7
B	3.0	D	1.0
B−	2.7	F	0.0

Suppose a student had the following grades on their courses: Compute this student's GPA.

Course	Credits	Grade
Survey of Literature	3	B−
Freshman Seminar	1	A
Physics I	4	C+
World Cultures	3	A−
Spanish I	3	B
Algebra II	4	D
Macroeconomics	3	B+

Solution.

$$\begin{aligned}
 \text{Semester GPA} &= \frac{\sum \text{credit} \cdot \text{weight}}{\sum \text{credits}} \\
 &= \frac{3(2.7) + 1(4.0) + 4(2.3) + 3(3.7) + 3(3.0) + 4(1.0) + 3(3.3)}{3 + 1 + 4 + 3 + 3 + 4 + 3} \\
 &= \frac{55.3}{21} \\
 &= 2.633
 \end{aligned}$$

Problem 3. (10pt) Compute the following percentages:

- (a) 40% of 260
- (b) 35% of 1050
- (c) 110% of 37
- (d) 13% of 810

Solution.

(a)

$$260(0.40) = 104$$

(b)

$$1050(0.35) = 367.5$$

(c)

$$37(1.10) = 40.7$$

(d)

$$810(0.13) = 105.3$$

Problem 4. (10pt) Compute the following:

- (a) 600 increased by 80%
- (b) 28 decreased by 60%
- (c) 730 increased by 170%
- (d) 45 decreased by 99%

Solution.

(a)

$$600(1 + 0.80) = 600(1.80) = 1080$$

(b)

$$28(1 - 0.60) = 28(0.40) = 11.2$$

(c)

$$730(1 + 1.70) = 730(2.70) = 1971$$

(d)

$$45(1 - 0.99) = 45(0.01) = 0.45$$

Problem 5. (10pt) Convert 15 mi/min to m/s. [1 mi = 5280 ft; 1 m = 3.28084 ft]

Solution.

$$\frac{15 \text{ mi}}{1 \text{ min}} \times \frac{5280 \text{ ft}}{1 \text{ mi}} \times \frac{1 \text{ m}}{3.28084 \text{ ft}} \times \frac{1 \text{ min}}{60 \text{ s}} = 402.336 \text{ m/s}$$

Problem 6. (10pt) How many feet are in 1 furlong? [1 furlong = $\frac{1}{8}$ mi; 1 mi = 5280 ft]

Solution.

$$\frac{1 \text{ furlong}}{1 \text{ furlong}} \cdot \frac{\frac{1}{8} \text{ mi}}{1 \text{ furlong}} \cdot \frac{5280 \text{ ft}}{1 \text{ mi}} = 660 \text{ ft}$$

Problem 7. (10pt) Convert $0.1 \text{ mi}^2/\text{s}$ to ft^2/min . [$1 \text{ mi} = 5280 \text{ ft}$]

Solution.

$$\frac{0.1 \text{ mi}^2}{1 \text{ s}} \cdot \frac{5280 \text{ ft}}{1 \text{ mi}} \cdot \frac{5280 \text{ ft}}{1 \text{ mi}} \cdot \frac{60 \text{ s}}{1 \text{ min}} = 1\,672\,704\,000 \text{ ft}^2/\text{min}$$

Problem 8. (10pt) Sand is filling into a giant rectangular container that is 5 ft wide, 8 ft long, and 1.5 ft deep. If the sand is flowing in at a rate of $0.6 \text{ ft}^3/\text{min}$, how long until the container is full?

Solution. We know the volume of the rectangular container is $V = lwh$. But then we know that the volume is $V = lwh = 5 \cdot 8 \cdot 1.5 = 60 \text{ ft}^3$. But then we have...

$$\text{Total} = \text{Rate} \cdot \text{Time}$$

$$60 \text{ ft}^3 = 0.6 \text{ ft}^3/\text{min} \cdot t$$

$$t = \frac{60}{0.6} \text{ min}$$

$$t = 100 \text{ min}$$

Therefore, the sand will fill the container in 100 minutes, or 1 hour and 40 minutes.

Problem 9. (10pt) Suppose a horse bet pays \$19 for every \$2.50 bet. If you bet \$227 and win, how much should you expect to be paid?

Solution. Comparing ratios, we have...

$$\frac{\$19}{\$2.50} = \frac{x}{\$227}$$

$$2.50x = 4313$$

$$x = \$1725.20$$

Therefore, you should be paid \$1,725.20.

Problem 10. (10pt) If you use 5 bags of flour every 7 months, how many should you purchase to have enough flour to last you 3 years? If a bag of flour costs you \$4.19, how much do you spend purchasing this amount?

Solution. Three years is 36 months. But then we have...

$$\frac{5 \text{ bags}}{7 \text{ months}} = \frac{x}{36 \text{ months}}$$

$$7x = 180$$

$$x = 25.71 \text{ bags}$$

Therefore, you will need 26 bags of flour to last the 3 years. But this will cost...

$$\text{Total Cost} = \text{Price} \cdot \text{Bags} = 4.19 \cdot 26 = \$108.94$$