"On my honor, as an Aggie, I have neither given nor received unauthorized aid on this academic work."

__________________________
Signature of student

My signature in this blank allows my instructor to pass back my graded exam in class or allows me to pick up my graded exam in class on the day the exams are returned. If I do not sign the blank or if I am absent from class on the day the exams are returned, I know I must show my Texas A&M student ID during my instructor’s office hours to pick up my exam.

Signature of student ________________________________

You are authorized to use a pencil, eraser, and your own TAMU student ID; use of anything else is a violation of the Aggie Honor Code.

Note: It is a violation of the Aggie Honor Code to continue writing on the exam after time is called and in doing so will result in a zero for this exam and will be reported to the Aggie Honor Council.

**ALL CELL PHONES MUST BE TURNED OFF AND PLACED AT THE FRONT OF THE ROOM! It is academic dishonesty to have any electronic devices, including cell phones, on your person during this exam. Having an electronic device on your person can result in a zero on this exam and an F* for this course.**

The location of the decimal point is often a mystery to kids, too, but not for this student...

A math teacher wrote 15.1 on the board. “This is what happens if we multiply by 10,” she said, and then erased the decimal point.

“Now where’s the decimal point?” she asked.

A student answered, “On the eraser!”

-https://mathjokes4mathyfolks.wordpress.com/tag/decimal/
(10 pts: 1 pt for each TF) On problems 1 through 10, circle either “True” or “False.”

1. True or False: An example of a ratio is \( \frac{2}{3} = \frac{4}{6} \). This is a proportion.
2. True or False: 64% of 3 is 1.92.
3. True or False: Rational numbers are closed under division.
4. True or False: The following numbers are rational: \( \frac{-1}{3}, 0, 4.439, \frac{-5\sqrt{3}}{9\sqrt{3}} \).
5. True or False: The additive inverse of \( -\frac{4}{5} \) is \( \frac{19}{5} \).
6. True or False: \( 2.9 = 3 \).
7. True or False: The set \( \left\{ -\frac{5}{2}, 0, \frac{5}{2} \right\} \) is closed under addition.
8. True or False: 0.04% is 4.
9. True or False: The rational numbers have the associative property of addition.
10. True or False: An example of the commutative property of multiplication of rational numbers is \( \left( \frac{4}{5} \right) \left( \frac{2 + 1}{3 + 2} \right) = \left( \frac{2 + 1}{3 + 2} \right) \left( \frac{4}{5} \right) \).

**# 11 – 18 Short Answer (8 pts total - 1 pt each – no work needed)**

11. Subtraction is defined in terms of **addition**.

12. Convert 0.00567 into scientific notation. \( 5.67 \times 10^{-3} \)

13. If there are 20 fish (12 sun fish and 8 catfish), what is the ratio of catfish to sun fish? \( \frac{8}{12} \)

14. Round 95,876.25678 to the nearest ten thousandth. \( 95,876.2568 \)

15. If \( b, d > 0 \), then \( \frac{a}{b} > \frac{c}{d} \) if, and only if \( ad > bc \).

16. Using circle sectors, model the fraction \( \frac{3}{5} \).

17. “How many \( \frac{3}{4} \) are in \( \frac{2}{5} \)” means what? (Translate into a math expression.) \( \frac{2}{5} \div \frac{3}{4} \)

18. Fully simplify \( \frac{x^5 y^4 z^2}{x^3 y^2 z} \) using positive exponents. \( x^{2+8} y^{1-3} z^{7-1} \)
19. (4 pts) Using base-ten blocks where a block represents one, model and compute $1.23 - 1.204$.

$$
1.23 \quad - \quad 1.204 \quad = \quad 0.026
$$

20. (4 pts) Model and compute $\frac{3}{5} \div \frac{5}{6} = \frac{15}{24} = \frac{5}{8}$

21. (5 pts) Model and compute $\frac{1}{2} \div \frac{2}{5} = \frac{4}{4} + \frac{1}{4} = \frac{5}{4} = 1 \frac{1}{4}$

22. (4 pts) Calculate $3.5 \div 0.08 = 43.75$

$$
3.5 \div 0.08 = \frac{350}{8} = 43.75
$$

OR

$$
0.08 \overline{3} 5 \overline{0} 0 \overline{0} 0
$$
23. (4 pts) Calculate \( \frac{2}{3} + \frac{4}{5} \) and leave your fully simplified answer as an improper fraction.

\[
\frac{2}{3} + \frac{4}{5} = \frac{2}{3} \left( \frac{5}{5} \right) + \frac{4}{5} \left( \frac{3}{3} \right) = \frac{10 + 4 \cdot 2}{15} = \frac{52}{15}
\]

24. (4 pts) On a map, 2 inches represents 15 miles. If two cities are 2.4 inches apart on the map, how many miles are they apart?

\[
\text{map} \quad 2'' \quad 2.4'' \quad \frac{x}{2.4} = \frac{15}{2} \quad x = \frac{(15)(2.4)}{2} = (15)(1.2) = 18 \text{ miles}
\]

25. (4 pts) State the Fundamental Law of Fractions and then give an example.

\[
\frac{a}{b} = \frac{a \cdot n}{b \cdot n} \quad \text{where} \quad a, b, n \quad \text{are any numbers such that} \quad b, n \neq 0.
\]

OR

The value of the fraction does not change if its numerator and denominator are multiplied by the same nonzero number.

Example: \( \frac{2}{3} = \frac{4}{6} \) or \( \frac{2}{3} = \frac{2 \cdot 2}{3 \cdot 2} \)

26. (5 pts) Write \( \frac{63}{175} \) as a terminating decimal, if possible, using the methods discussed in class (not using long division). If it is not possible, explain why.

\[
\frac{63}{175} = \frac{3^2 \cdot 7}{5^2 \cdot 7} = \frac{3^2}{5^2} \left( \frac{2^3}{2^3} \right) = \frac{(9)(4)}{10^2} = \frac{36}{100} = 0.36
\]

\[
\frac{175}{3} = 58.333\ldots, \quad \frac{135}{7} = 19.285\ldots, \quad \frac{63}{7} = 9.0\ldots
\]
27. (3 pts) Fully simplify \( \frac{\frac{1}{3} + \frac{2}{4}}{1 - \frac{1}{4}} \).

\[
= \left( \frac{7}{3} \right) \left( \frac{4}{3} \right) = \frac{28}{9}
\]

28. (3 pts) Define rational number.

\[ \mathbb{Q} = \left\{ \frac{a}{b} \mid a, b \in \mathbb{Z}; b \neq 0 \right\} \]

Or

Any rational number can be written as a ratio of two integers.

29. (5 pts) Convert 1.203 to a ratio of integers in simplest terms.

\[
1.203 = 1.20303
\]

\[
100 \times 1.203 = 120.303
\]

\[
-99 = -120.303
\]

\[
99n = 119.1
\]

\[
\frac{n}{99} = \frac{1191}{990}
\]

30. (4 pts) Prove \( \frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd} \) where \( b, d \neq 0 \).

\[
\frac{a}{b} + \frac{c}{d} = (\frac{a}{b})(\frac{d}{d}) + (\frac{b}{d})(\frac{c}{d}) = \frac{ad}{bd} + \frac{bc}{bd} = \frac{ad + bc}{bd}
\]
31. (5 pts) A store has a shirt that is 16% off of the original price, and with a coupon you can get an additional 5% off. What is your total percent discount?
\[
16\% + 5\% \left( 100 - 16 \right) 9\% = 0.16 + 0.05 \left( 0.84 \right) = 0.16 + 0.0420 = 0.2020 = 20.2\%
\]

32. (5 pts) Find a rational number between \( \frac{5}{8} \) and \( \frac{9}{22} \). Show your work and give your answer using inequality symbols.
\[
\frac{5}{8} > \frac{9}{22} \quad \text{iff} \quad \left( \frac{5}{8} \right) \left( 22 \right) > \left( \frac{9}{22} \right) \left( 22 \right) \quad \text{iff} \quad 110 > 72, \quad \ast
\]
\[
\frac{9}{22} < \frac{9 + 5}{22 + 8} < \frac{5}{8} \quad \text{iff} \quad \frac{9}{22} < \frac{14}{30} < \frac{5}{8} \quad \text{iff} \quad \frac{9}{22} < \frac{7}{15} < \frac{5}{8}
\]
\[
\left( \ast \quad \frac{5}{8} = \left( \frac{5}{8} \right) \left( 11 \right) = \frac{55}{88} ; \quad \frac{9}{22} = \left( \frac{9}{22} \right) \left( 4 \right) = \frac{36}{88} \right) \quad \text{iff} \quad \frac{9}{22} < \frac{37}{88} < \frac{55}{88}
\]

33. (4 pts) Correctly and properly write the number 3.67 in words.

Three and sixty-seven hundredths

34. (6 pts) Given 2.34.

a. What is its fractional meaning?
\[
2 + \frac{3}{10} + \frac{4}{100}
\]

b. Write it as an improper fraction in lowest terms.
\[
2 \frac{34}{100} = \frac{200 + 34}{100} = \frac{234}{100} = \frac{117}{50}
\]

c. Represent it as a mixed fraction in lowest terms.
\[
2 \frac{34}{100} = 2 \frac{17}{50}
\]

d. Give its equivalent expanded place value form.
\[
2 \cdot 10^0 + 3 \cdot 10^{-1} + 4 \cdot 10^{-2}
\]

e. Give its equivalent as a percentage.
\[
234\%
\]
35. (5 pts) Use the definition of less than to prove \(-\frac{2}{3} < \frac{-2}{5}\).

\[-\frac{2}{3} < \frac{-2}{5} \text{ iff there exists a positive rational number } k \text{ such that } -\frac{2}{3} + k = -\frac{2}{5}.

Here \(k = \frac{17}{15}\).

\[\begin{align*}
-\frac{2}{3} + k &= \frac{-2}{5} \\
\frac{17}{15} &= \frac{-2}{3} + \frac{9}{5} \\
\frac{17}{15} &= \left(\frac{-2}{3}\right)\left(\frac{3}{5}\right) + \frac{9}{5} \cdot \frac{3}{5} \\
\frac{17}{15} &= \frac{-10}{15} + \frac{27}{15} \\
\frac{17}{15} &= \frac{17}{15}
\end{align*}\]

36. (5 pts) Prove \(\frac{q}{1} = q\) where \(q\) is any rational number.

By the definition of division of rational numbers,
\(q \div 1 = x\) iff \(x\) is a unique rational number such that \(q = 1x\). By the multiplicative identity of rational numbers \(1x = x\), so \(q = 1x = x\), that is \(q = x\).

Therefore \(q \div 1 = q\).

5-point Bonus: Explain to a student why when they divide \(-\) by \(-\text{third}\), they get a bigger number.

![Diagram of dividing three pieces into four parts]

4 = 12 thirds

Since \(\frac{1}{3}\) will go into four, 12 times, \(4 \div \frac{1}{3} = 12\).