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

________________________________
Signature of student

Academic Integrity Task Force, 2004

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 ____________________________________________

Write all solutions in the space provided as full credit will not be given without complete, correct accompanying work, even if the final answer is correct. Use techniques taught in class to solve; do not use brute force (do not use “list by exhaustion” unless that is the only way to solve the problem). Fully simplify all your answers, and give exact answers unless otherwise stated. Make sure that you indicate your answer clearly by circling your response.

Old mathematicians never die; they just lose some of their functions.
(10 pts: 1 pt for each TF) On problems 1 through 10, circle either "True" or "False."

1. True or False: Two properties of additive inverse are \((-a) = a\) and \((-a + b) = -a + -b\).

2. True or False: "\(\leq\)" is an equivalence relation.

3. True or False: If \(ac = bc\), then \(a = b\).

4. True or False: Function composition is commutative.

5. True or False: "Is a sibling to" is symmetric but not reflexive.

6. True or False: If \(x < y\) and \(n < 0\), then \(nx > ny\).

7. True or False: \(-x - |x| + x = x\) where \(x\) is an integer.

8. True or False: Every function is a relation.

9. True or False: \((a + b)^2 = a^2 + b^2\)

10. True or False: An example of mental math is \(336 ÷ 8 = (320 + 16) ÷ 8 = (320 ÷ 8) + (16 ÷ 8) = 40 + 2 = 42\).

11. (5 pts) Simplify fully: \(6^0 + 40 ÷ 5 \cdot 2 \left| -6^2 - |-4\right| - (\neg 3)\)

12. (6 pts) Write each of these in algebraic form.

   a. The sum of 4 and three times a number: __________________________

   b. For every 7 dog owners (D), there are 5 cat owners (C): __________________________

13. (3 pts) Name 3 ways functions can be represented.

14. (4 pts) If \(f(x) = 2x - 7\) and \(g(x) = 5x + 3\), find and simplify \((g \circ f)(x)\).
15. (4 pts) Use the partition set model to illustrate and calculate $8 \div 2$.

16. (5 pts) Use lattice multiplication to calculate $57_{nine} \times 68_{nine}$.

17. (4 pts) Use short division to calculate $2247 \div 3$.

18. (4 pts) Use the number line model (with fish) to calculate $\frac{-1}{-4}$.

19. (5 pts) Calculate $1332_{four} \div 32_{four}$.
20. (6 pts) Use base-ten blocks to model and calculate $14 \times 23$. Clearly indicate all trading (regrouping) steps.

21. (6 pts) Use the charged field model to calculate the following.
   
   a. $-4 + 2$
   
   b. $-2 \cdot -3$

22. (3 pts) Use mental math to calculate $35 + 49$. Clearly indicate your ‘mental’ steps.

23. (4 pts) Completely factor (over the integers): $48x^4y - 243y$
24. (7 pts) An estate of $1000 is left to four siblings. The youngest is to receive twice as much as the eldest. The other two siblings are each to receive $200 more than the eldest. How much will each receive?

   a. Define your variable.

   b. Set up ONE equation.

   c. Solve the equation.

   d. The eldest will receive __________, the second child will receive __________, the third child will receive __________, and the youngest will receive __________.

25. (3 pts) Given the relation \{(1,2),(3,4),(5,6),(a,8)\}. Name all of the values of \(a\) which would make this relation not be a function.

   \(a = \) _____________________________

26. (3 pts) Use the definition of less than to prove \(\neg 4 < \neg 1\).
27. (7 pts) Prove $\frac{0}{0}$ is undefined.

28. (4 pts) Prove $(-a)(-b) = ab$.

29. (7 pts) For integers $x$ and $y$, prove if $x < y$, then $-x > -y$. 