

Write your name on the cover of the test booklet and nowhere else. Enclose this sheet with the booklet. Failure to follow these directions will cost you 1 point. The test has 100 points (to be scaled up to 225 points) and is scheduled to take 50 minutes. Therefore, expect to spend 1 minute for every 2 points. For example, a 12-point question should take 6 minutes. I cannot give extra time because some students have a class after your class.

1) (6 points each) For TWO of the following variables, determine the *dimension*, a.k.a. *units*, of the variable. State your logic.

- A) price of gasoline
- B) interest rate
- C) marginal productivity of labor

2) (8 points) Answer EITHER Part A OR Part B.

- A) Plot $X > 12$ on a number line. Also plot $3 < X \leq 8$ on the same number line. **Briefly** state how you got your graph.
- B) Plot the point $(-3, 7, 2)$ on a graph. **Briefly** state how you found it.

3) (12 points) Answer EITHER Part A OR Part B.

- A) Give an example of a function from Economics, Business, or Accounting which is discontinuous. Explain how you know it is discontinuous.
- B) Draw a function which is not differentiable everywhere. Explain how you know it is not differentiable.

4) (14 points) Answer EITHER Part A OR Part B.

- A) We talked about discrete compounding and continuous compounding. What is the difference? Which would you use for bank interest and which would you use for GDP? Explain your logic.
- B) Are the series associated with the sequences $a_n = 2 \cdot (-1)^n$ and $b_n = (-2)^n$ definitely divergent, divergent, or convergent? Explain your logic for each one.

5) (16 points) Answer EITHER Part A OR Part B.

- A) Suppose that you had a sequence of payments (like Publishers' Clearing House \$1000 a week forever) whose present value were given by $a_n = 1000/(1+r)^n$. Is the series s_n which comes from the a_n a geometric series? Explain your logic. Determine whether the $\lim_{n \rightarrow \infty} s_n$ converges. If it does converge, what does it converge to and how do you know? If it does not converge, how can you tell it does not?
- B) Suppose a bond has a face value of \$1000, coupon rate of 10% with interest paid semi-annually, and a maturity date of 8 years from now. If the bond is selling for \$990, then what is the internal rate of return? Set up the calculation and state how you got each number. Do not actually solve the equation.

6) (18 points) Answer EITHER Part A OR Part B.

- A) Draw a Venn diagram for the universal set being students at Bethany College. Put areas for registered Democrats (D), registered Republicans (R), and athletes (A). Given your diagram, approximately how large is $\overline{D} \cap A$? State how you reached that conclusion.
- B) Suppose the universal set is $U = \{x \in \mathbf{Z}_+ \ \& \ x \leq 10\}$, $E = \{1, 3, 5, 7, 9\}$, $F = \{2, 4, 6\}$, $G = \{5, 7\}$. Find $E \cup F$, $E \cap \overline{G}$, and $G \cup F$. Briefly explain how you got each answer.

7) (20 points) Answer EITHER Part A OR Part B.

- A) Suppose that a utility function for food (F) and gasoline (G) is given by $U(F,G) = F^2 + G^2$. Plot one of the level curves, a.k.a. indifference curves. Determine if it is strictly quasi-concave, quasi-concave, quasi-convex, strictly quasi-convex, or neither. Explain your logic. (This is not a legitimate utility function, so it will not look normal.)
- B) Plot both $MC = \frac{1}{2}(Q-4)^2 + 3$ for $0 \leq Q \leq 8$ and $U(F) = \log_2(F)$ for $0 < F \leq 8$. Find a few key points and state how you found them.