

This take-home exam is DUE at the *beginning* of class, Thursday, April 14, 2016. You must hand in a physical copy of your answers and work.

1 Multiple Choice (2 points each)

- (1) How many years does it take savings of \$10,000, invested at an annual interest rate of 6.7% and compounded monthly, to appreciate to \$13,966.38?

(A) $t = 5$ years (B) 4.5 (C) 2.5 (D) 4.98

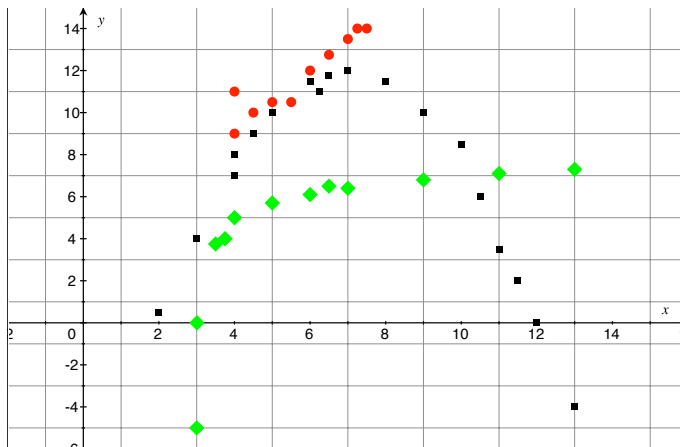
- (2) Suppose a country has an economic growth rate of 1.8% compounded continuously. Exactly how many years will it take for the level of economic output to double?

(A) 28.9 (B) 0.38 (C) 38.5 (D) 39

- (3) The slope of a function can be interpreted as a _____ of the independent variable.

(A) total effect (B) marginal effect (C) vertical intercept (D) starting point

- (4) Suppose the black square data points in the graph below represent observations of a firm's revenue as a function of units sold. Select the revenue function that best describes this graph.



(A) $R(x) = -10(x - 5)^2 + 8$

(B) $R(x) = (x + 7)^2 + 12$

(C) $R(x) = -\frac{1}{2}(x - 7)^2 + 8$

(D) $R(x) = -\frac{1}{2}(x - 7)^2 + 12$

- (5) Now, suppose the red circles in the above graph represent observations from a firm's cost function. Select the cost function that best fits these points.

(A) $C(x) = -2.1x + 8.3$

(C) $C(x) = \frac{3}{2}x + 3$

(B) $C(x) = 0.54x + 3.6$

(D) $C(x) = 1.51x + 8.2$

- (6) Finally, suppose the green diamonds in the above graph represent observations from some other firm's nonlinear cost function. Select the nonlinear cost function that best fits these points.

(A) $C(x) = -e^{-(x-3)}$

(C) $C(x) = \ln(x - 3)$

(B) $C(x) = -e^{-(x-3)} + 4$

(D) $C(x) = \ln(x - 3) + 5$

- (7) Fill in the blanks: A vertical line has a slope of _____ and a 45 degree line has a slope of _____.
- (A) undefined, 1 (B) 0, undefined (C) $\infty, \frac{1}{2}$ (D) undefined, ∞
- (8) Rewrite the exponential equation $10^{0.4771} = 3$ as a logarithmic equation.
- (A) $0.4771 = \log 3$ (C) $0.4771 = \log_9 10$
(B) $3 = \log 0.4771$ (D) $0.4771 = \log 10$
- (9) The profit function of a firm for a given level of output x is estimated by nonlinear regression to be $P(x) = -(x - 375)^2 + 1,200$. What is the production level at which profit is maximized? What is maximum profit?
- (A) $x = -375, P(x) = 600$ (C) $x = 37.5, P(x) = 120$
(B) $x = 375, P(x) = 1,200$ (D) $x = 200, P(x) = 500$
- (10) Use the properties of logarithms to solve for x : $\ln(3x - 4) = \ln 20 - \ln(x - 5)$ (Hint: Don't forget the domain of the \ln function.)
- (A) $x = 5, \frac{5}{3}$ (B) $x = 0, \frac{19}{3}$ (C) $x = -5, \frac{-19}{3}$ (D) $x = \frac{19}{3}$

2 Written Answer (3 points each)

Remember: number problems clearly, show all of your work, and circle your final answer.

- (11) An initial investment of \$20,000 is invested for 2.5 years in an account that earns 1.2% interest continuously compounded. The balance is then transferred to a certificate of deposit that pays 2% interest, compounded quarterly, for a period of 1 year. What is the final value of the investment?
- (12) Suppose a \$2,000 college loan compounds continuously at 5%. Assuming you delay repayment, how many years until your debt grows to \$2,500?
- (13) (a) Write down a nonlinear model (i.e. equation) to describe the relationship between any two economic or financial variables of your choosing. Don't forget to define the variables.
(b) Describe how the relationship between variables changes for different values in the domain of the independent variable, i.e. when is the slope positive? negative?
- (14) Graph the nonlinear model you wrote down above.