This exam is closed book. No graphing calculators are allowed. No bathroom breaks are permitted while taking the exam. Be sure to read through the entire exam for hints and useful formulas. Remember to check answers that can be checked. Good luck!

1 Multiple Choice (2 points each)

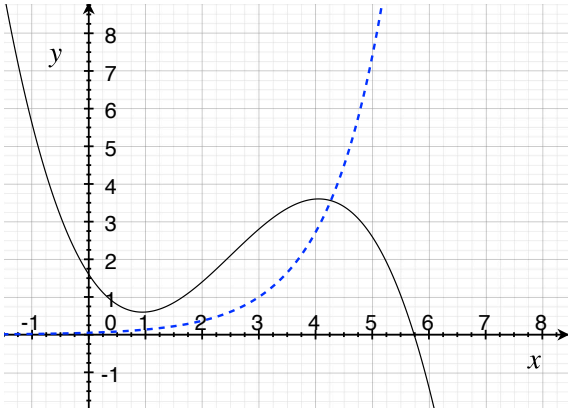
(1) Find the *break-even point* for a firm whose cost and revenue functions are $C(x) = 15x + 12,000$ and $R(x) = 18x - 6,000$, respectively.

(A) $x = 6,000$ (B) $x = 12,000$ (C) $x = 3,000$ (D) $x = 4,000$

(2) The profit function of a firm for a given level of output x is estimated by, $P(x) = -(x - 200)^2 + 500$. What is the production level at which profit is maximized? What is maximum profit?

(A) $x = 250$, $P(x) = 600$
(B) $x = 400$, $P(x) = 1,200$
(C) $x = -200$, $P(x) = 500$
(D) $x = 200$, $P(x) = 500$

(3) Choose the function representing the dotted-line in the graph below.



(A) $f(x) = \ln(x)$
(B) $f(x) = \log(x)$
(C) $f(x) = e^{x-3}$
(D) $f(x) = x^3$

(4) The solid line in the graph above describes a polynomial function with a maximum degree of what?

(A) 2 (B) 3 (C) 4 (D) 5

(5) Suppose the solid line in the graph in (3) models the relationship between daily pushups x (in dozens) and weight gain y. What is the domain of pushups for which there is a *positive* marginal effect on weight gain?

(A) $x \in [12, 48]$ (B) $x \in (-\infty, \infty)$ (C) $x \in [4, 6]$ (D) $x \in [0, 1]$

(6) Rewrite the exponential equation $10^{0.4771} = 3$ as a logarithmic equation.

(A) $0.4771 = \log 10$
(B) $3 = \log 0.4771$
(C) $0.4771 = \log_9 10$
(D) $0.4771 = \log 3$

(7) How long would it take for an investment P to triple in value if compounded continuously at a rate of 3.5%? (NOTE: $A = Pe^{rt}$)

(A) 19.8 yrs (B) 20 yrs (C) 31.4 yrs (D) 35 yrs

(8) Solve the linear system using any method: $\begin{array}{rrl} 3x & & = 9 \\ 2x & +7y & = 55 \end{array}$

(A) (3,7) (B) (7,3) (C) (1,7) (D) (3,6)

(9) Find the inverse $\mathbf{M}^{-1}$ (if it exists) of the square matrix, $\mathbf{M} = \begin{bmatrix} 6 & 7 \\ 7 & 8 \end{bmatrix}$.

(A) Does Not Exist (B) $\begin{bmatrix} -8 & 7 \\ 7 & -6 \end{bmatrix}$ (C) $\begin{bmatrix} 6 & -7 \\ -7 & 8 \end{bmatrix}$ (D) $\begin{bmatrix} 8 & 7 \\ 7 & 6 \end{bmatrix}$

(10) Perform the operation if possible: $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \times \begin{bmatrix} 3 & 5 \end{bmatrix}$

(A) $\begin{bmatrix} 3 & 5 \end{bmatrix}$ (B) Not Conformable (C) $\begin{bmatrix} 5 & 3 \end{bmatrix}$ (D) $\begin{bmatrix} 8 \end{bmatrix}$

2 Written Answer **(3 points each)**

NOTE: You must show all work to receive full credit!

(11) The graph of $g(x) = -\sqrt{x+1} - 2$ is derived from the graph of elementary function $f(x) = \sqrt{x}$. List each one of the transformations of $f(x)$ and graph $g(x)$.

(12) Suppose a \$2,000 college loan compounds quarterly at 5%. Assuming you make no payments, how long until you owe \$2,500? (NOTE: $A = P(1 + \frac{r}{m})^{mt}$)

(13) If $\mathbf{A} = \begin{bmatrix} 5 & 7 \\ -3 & 8 \\ 2 & -1 \end{bmatrix}$ and $\mathbf{B} = \begin{bmatrix} 1 & 1 & 0 & 2 \\ 0 & 2 & 1 & 1 \end{bmatrix}$, find both $\mathbf{AB}$ and $\mathbf{BA}$.

(14) There exist three concert halls available for a touring band called The Matrices to book, each with a maximum capacity and revenue sharing minimum (i.e. the band earns ticket sales only above this threshold). There are also two types of tickets to sell for each show, one for \$5 and another for \$10.

Venue	Roxbury	Orpheum	Barrymore
Capacity	1,000	2,000	3,000
Rev. Shr. Min.	\$5,000	\$ 10,000	\$ 20,000

Let x_1 represent the number of \$5 tickets sold and x_2 represent the number of \$10 tickets sold. Use a matrix equation ($\mathbf{AX} = \mathbf{B}$) to find how many tickets of each type must be sold at each venue in order for the band to earn ticket sales revenue while selling out the venue.