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)** Expand completely: $(2m + 3n)^3$

(A) $8m^3 + 27n^3$
(B) $8m^3 + 12mn + 27n^3$
(C) $8m^3 + 36m^2n + 54mn^2 + 27n^3$
(D) $4m^3 + 12m^2n + 12mn^2 + 9n^3$

**(2)** Find the sum of all odd integers from 9 to 2,477. (HINT: $S_n = \frac{n}{2}(a_1 + a_n)$.)

(A)1,535,105 (B) 1,533,862 (C) Cannot sum (D) 3,063,995

**(3)** Solve using any method: $3x^2 + 25x + 38 = 0$

(A) $x = -2, \frac{-19}{3}$ (B) $x = 0$ (C) $x = 2, \frac{19}{3}$ (D) No real roots

**(4)** In an unusual economy, the supply curve is perfectly elastic and defined by $p = 3$ while the demand curve is perfectly inelastic and defined by $x = 4$. Find equilibrium price and quantity. (HINT: Sketch the curves.)

(A) $p^* = 3.5, x^* = 3.5$
(B) $p^* = 4, x^* = 3$
(C) No equilibrium exists
(D) $p^* = 3, x^* = 4$

**(5)** Fill in the blanks: a horizontal line has a slope of _____ and _____ a function while a vertical line has a slope of _____ and _____ a function.

(A) 0, is, undefined, is not
(B) undefined, is not, 0, is
(C) $\infty$, is, 1, is not
(D) 0, is not, $\infty$, is

**(6)** Find the sum of the infinite series: $\frac{1}{.03125}, \frac{1}{.0625}, \frac{1}{.125}, \ldots$ (HINT: $S_\infty = \frac{a_1}{1-r}$ ).

(A) Cannot sum (B) 0.625 (C) 64 (D) 6.25

**(7)** Factor completely: $x^3 - 49x$

(A) $x(x^2-49)$ (B) $x(x+7)(x-7)$ (C) $x(x-7)^2$ (D) $(x-7)(x^2+7x+14)$

**(8)** Due to tax breaks, individuals have an extra \$900 of disposable income. Assume consumers spend 85% of this income. Because one person's spending is another's income, this initial spending "stimulates" the economy, all else equal. What is the total additional spending in the economy?

(A) \$6,000 (B) \$5,100 (C) $\infty$ (D) \$4,667

**(9)** Which is greater, $18.6 \times 10^7$ or $1.86 \times 10^8$ ?

(A) $18.6 \times 10^7$ (B) $1.86 \times 10^8$ (C) Can't determine (D) Equal

**(10)** Rationalize and simplify: $\frac{\sqrt{a+h}-\sqrt{a}}{h}$

(A) $\frac{1}{\sqrt{a+h}-\sqrt{a}}$ (B) $\frac{\sqrt{a+h}+\sqrt{a}}{h}$ (C) $\frac{h}{\sqrt{a+h}+\sqrt{a}}$ (D) $\frac{1}{\sqrt{a+h}+\sqrt{a}}$

## 2 Written Answer (3 points each)

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

**(11)** Show that the *slope-intercept* form of a linear equation ($y = mx + b$ ) can be derived from *point-slope* form ($y - y_1 = m(x - x_1)$ ). (HINT: Use $y$-intercept as point $(x_1, y_1)$ )

**(12)** Suppose a grandparent deposits \$100 for you each year, starting on your first birthday, into a savings account earning 3% annually. What is the total sum (including principal) you will receive after your $18^{th}$ birthday? (HINT: The first \$100 earns 3% for 18 years. The second for 17, and so on. A geometric series sum is $S_n = \frac{ra_n - a_1}{r-1}$ where $a_n = a_1 r^{n-1}$.)

**(13)** (i) Draw a linear relationship between two variables of your choice.
(ii) Write down a linear function estimating the relationship, in accordance with your graph in part (i).
(iii) Describe the *marginal effect* of the dependent (horizontal axis) variable on the independent variable (vertical axis).

**(14)** Recall the quadratic formula, $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$.
(i) Describe the number of real solutions to $ax^2+bx+c = 0$ when the *discriminant* is positive, zero, and negative, respectively.
(ii) Describe what a solution represents.

## 3 Extra Credit (May hand in Tuesday, OCT 13. 3 points)

Prove that if the coefficients of a quadratic equation ($ax^2 + bx + c = 0$) sum to zero, such that $a + b + c = 0$, then the solutions must be $x = \frac{c}{a}, 1$. (HINT: Solve for $b$ in $a + b + c = 0$ and then substitute for $b$ into the quadratic formula.)