This take-home exam is DUE at the *beginning* of class, Thursday, March 10, 2016. You must hand in a physical copy of your answers and work.

1 Multiple Choice **(2 points each)**

(1) What is the degree of the second term in following polynomial: $5x^3 + \sqrt{3}x - \frac{1}{2}$

(A) 3 (B) 1 (C) $\frac{1}{2}$ (D) 0

(2) Expand and simplify the following: $-3x\{x[x - x(2 - x)] - (x + 2)(x^2 - 3)\}$

(A) $3x^3 + 6x^2 - 27x$ (B) $x^3 + 6x^2 - x$

(C) $9x^3 - 9x^2 - 18x$ (D) $3x^2 + 6x - 18$

(3) Suppose you are investing \$5,000, one portion at 9% and the remainder at 4%. If x is the amount invested at 9%, write an algebraic expression describing total annual income from both investments.

(A) $.09x + .04(1 - x)$ (B) $450 - .05x$ (C) $.09(5000 - x) + .04x$ (D) $200 + .05x$

(4) Factor completely: $y^4 - 3y^2 - 4$

(A) $(y^2 + 1)(y^2 - 4)$ (B) $y^2(y^2 - 3) - 4$

(C) $(y^2 + 1)(y + 2)(y - 2)$ (D) Cannot factor into integer coefficients

(5) Reduce the compound fraction to lowest terms: $\dfrac{\frac{1}{5(z+c)} - \frac{1}{5z}}{c}$

(A) $\frac{-1}{5z(z+c)}$ (B) $\frac{\frac{z-z+c}{5(z+c)z}}{c}$ (C) $\frac{1}{c}$ (D) $\frac{c}{(z+c)}$

(6) Select the true mathematical statement.

(A) $(2^3)^2 = 2^{3^2}$ (B) $2^{(3^2)} = (2^3)^2$ (C) $(2^2)^3 = 2^{2^2}$ (D) $(2^2)^2 = 2^{2^2}$

(7) Consider the general form of a power, r^n. If $r < 0$, then r has no square roots.

(A) TRUE (B) FALSE

(8) The formula $A = P(1+r)^5$ describes an asset's final value after an initial principal is invested at an annual interest rate for five years. Define the interest rate r in terms of the other variables.

(A) $\frac{\sqrt[5]{A-1}}{P}$ (B) $\sqrt[5]{\frac{A}{P}} - 1$ (C) $\frac{\sqrt{A}}{P} - 1$ (D) $\frac{A^5}{P} - 1$

(9) Using the formula derived above in (8), find the annual interest rate r (as a decimal) that yields a final value of \$2,828.52 from an initial investment of \$2,500.

(A) .025 (B) .035 (C) .077 (D) .13

(10) Expand the entire series without summation notation: $\sum_{j=0}^{4} \frac{(-1)^j x^{2j}}{2j+2}$

(A) $\frac{1}{2} + \frac{x^2}{4} + \frac{x^4}{6} + \frac{x^6}{8} + \frac{x^8}{10}$ (B) $\frac{-x^2}{4} + \frac{x^4}{6} - \frac{x^6}{8} + \frac{x^8}{10} - \frac{x^{10}}{12}$

(C) $\frac{1}{2} - \frac{x^2}{4} + \frac{x^4}{6} - \frac{x^6}{8} + \frac{x^8}{10}$ (D) $\frac{1}{2} - \frac{x^2}{4} - \frac{x^4}{6} - \frac{x^6}{8} - \frac{x^8}{10}$

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

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

(11) The following macroeconomic equation describes an accounting identity (i.e. fact) relating national saving (S) to total investment (I), government spending (G), tax revenue (T), exports (X) and imports (M):

$$(S - I) = (G - T) + (X - M).$$

Assume a country has a net zero trade balance ($X - M = 0$).

(a) Suppose a country experiences a government budget deficit, ($G > T$). What can we infer about the relationship between national saving (S) and investment (I)? Explain which is greater.

(b) Now, suppose a country experiences a government budget surplus, ($G < T$). Which is greater, national saving (S) or investment (I)? Explain.

(12) Show that whenever the *discriminant* in the quadratic formula, $b^2 - 4ac$, is equal to zero, the solution to $ax^2 + bx + c = 0$ must equal $-\sqrt{\frac{c}{a}}$.

(13) Show that the sum of the first n even, negative integers will always equal $-n - n^2$.

(14) An economist publishes a research paper arguing that the multiplier from a proposed fiscal stimulus of \$25,000,000,000 will be 1.15. In other words, the ratio of the total economic impact of the stimulus spending to the original amount spent by the government is 1.15. What share of the stimulus did the economist assume was spent as consumption?