MAC 1105 Review 1, Fall 2015

1. Let $A = \left\{\sqrt{2}, \frac{0}{3}, 0.\overline{9}, \sqrt{-4}, \pi, \sqrt[3]{-8}, \frac{3}{0}, \frac{15}{5}, \frac{1}{2}, 16^{1/4}, 0.08\right\}$, and list all elements of A which are: (a) natural numbers; (b) integers; (c) rational numbers; (d) irrational numbers; (e) real numbers.

2. Identify the properties illustrated by the following equations:
(a) $8(5+9) = (5+9)8$ (b) $4\cdot 6+4\cdot 12 = 4(6+12)$ (c) $3\cdot(4\cdot 2) = (3\cdot 4)\cdot 2$
(d) $-8+8=0$ (e) $(9+p)+0 = 9+p$

3. Simplify each expression:
(a) $(-4-1)(-3-5)-2^3$ (b) $(6-9)(-2-7)\div(-4)$ (c) $\dfrac{6(-4)-3^2(-2)^3}{-5[-2-(-6)]}$

4. Evaluate $\dfrac{3|-2|-4|4|}{|(-1)(4)|}$.

5. Perform the following operations:
(a) $2(3y^6-9y^2+2y)-(5y^6-4y)$ (b) $(8y-7)(2y+7)$ (c) $(4a-3b)^2$

6. Factor as completely as possible:
(a) $3(z-4)^2+9(z-4)^3$ (b) $6x^2-13x-5$ (c) $49a^8-9b^2$
(d) $8y^3-1000z^6$ (e) x^4-x^2-12 (f) $2x(4-3x)^{4/3}-4x^2(4-3x)^{1/3}$

7. Write the rational expression in lowest terms and state its domain: $\dfrac{12y^2-4y-5}{6y^2-y-2}$.

8. Perform the indicated operations and simplify:
(a) $\dfrac{x^2+x-2}{x^2+5x+6}\div\dfrac{x^2+3x-4}{x^2+4x+3}$ (b) $\dfrac{4x^2-4}{x^2-x+1}\cdot\dfrac{x^4+x}{x^2+2x+1}$ (c) $\dfrac{3}{x^2-4x+3}-\dfrac{2}{x^2-1}$

9. Simplify each complex fraction:
(a) $\dfrac{1-\frac{4}{x}+\frac{4}{x^2}}{1-\frac{5}{x}+\frac{6}{x^2}}$ (b) $\dfrac{\frac{3}{x}-\frac{4}{x+1}}{1-\frac{1}{x}}$

10. Simplify the following:
(a) $(8p^2q^3)(-2p^5q^{-4})$ (b) $\dfrac{-8y^7p^{-2}}{y^{-4}p^{-3}}$ (c) $(a^{3/4}b^{2/3})(a^{5/8}b^{-5/6})$ (d) $\left(\dfrac{25m^3n^5}{m^{-2}n^6}\right)^{-1/2}$

11. Simplify the following, assuming all variables represent positive real numbers:
(a) $\sqrt{200}$ (b) $\sqrt[3]{16}$ (c) $\sqrt{\dfrac{2^7y^8}{m^3}}$
(d) $\sqrt{18m^3}-3m\sqrt{32m}+5\sqrt{m^3}$ (e) $\dfrac{2}{7-\sqrt{3}}$

12. Solve each equation:
(a) $\frac{1}{6}x - \frac{1}{12}(x-1) = \frac{1}{2}$ (b) $5x-2(x+4) = 3(2x+1)$ (c) $9x-11(k+p) = x(a-1)$, for x

13. If the length of each side of a square is decreased by 4 inches, the perimeter of the new square is 10 inches more than half the perimeter of the original square. What are the dimensions of the original square?

14. Becky Anderson can ride her bike to the university library in 20 minutes. The trip home, which is all uphill, takes her 30 minutes. If her rate is 8 miles per hour faster on her trip there than her trip home, how far does she live from the library? (Hint: make sure to convert time to hours.)

15. To finance your education, you take out \$90,000 in two student loans. One loan has a 5.5% interest rate, and the other 6% interest. Together, the annual interest on the two loans is \$5125. How much did you borrow at each rate?

16. The linear model $y = 0.1132x + 0.4609$ approximates the U.S. minimum hourly wage in dollars, where x is the number of years after 1956. Use the model to approximate the following: (a) the minimum wage in 1990; (b) in what year the minimum wage was \$5.85.

17. Perform each operation and write in standard form:
(a) $(6-i)+(7-2i)$ (b) $(-11+2i)-(8-7i)$ (c) $(5-i)(3+4i)$
(d) $(4-3i)^2$ (e) $\dfrac{-12-i}{-2-5i}$

18. Find each power of i:
(a) i^{11} (b) i^{60} (c) i^{110} (d) i^{-27}

19. Solve each equation:
(a) $(y+1)^2 = 16$ (b) $2x^2 - x - 5 = 0$ (c) $x^2 - 3x + 3 = 0$

20. Solve for x by completing the square: $2x^2 - 3x - 1 = 0$.

21. Find the value k such that the equation $6x^2 + 3x + k = 0$ has one (repeated) real solution.

22. A projectile is fired straight up from ground level. After t seconds, its height s in feet above the ground is given by $s = 220t - 16t^2$. At what times is the projectile exactly 750 feet above the ground?