NAME: _____ OSIS: _____ MATH TEACHER: _____

Stuyvesant High School
J. Zhang, Principal

Form BLUE

MRS21 – Final Examination
January, 2016

CALCULATORS ARE NOT PERMITTED ON THIS EXAM

PART I: Answer ALL questions on your NCS Scantron Form. Darken the letter preceding the number or expression that best answers the question. [4 points each]

1. When $36x^3 - 45x^2 - 16x + 20$ is factored completely one factor is:

   (A) $9x^2 - 4$ (B) $9x^2 + 4$ (C) $3x - 2$ (D) $9x - 2$ (E) $4x + 5$

2. Which of the following is not equal to 4^8?

   (A) 2^{16} (B) $\sqrt[4]{2^{64}}$ (C) $\frac{4^{10}}{2^4}$ (D) $8^{\frac{16}{3}}$ (E) $\frac{8^{32}}{4^{16}}$

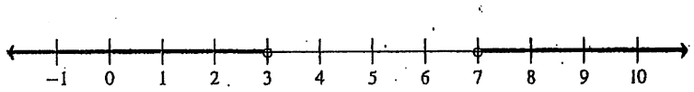
3. Find the center of the circle with equation $x^2 + y^2 - 4x + 6y - 20 = 0$.

   (A) $(-3, -2)$ (B) $(-3, 2)$ (C) $(2, -3)$ (D) $(-2, 3)$ (E) $(2, 3)$

4. What are the roots of the equation $x^2 + (x - 3)(x + 1) = 1 - 5x$?

   (A) $\frac{3 \pm \sqrt{41}}{2}$ (B) $\frac{-3 \pm \sqrt{41}}{2}$ (C) $\frac{3 \pm \sqrt{41}}{4}$ (D) $\frac{-3 \pm \sqrt{41}}{4}$ (E) $\frac{-3 \pm i\sqrt{23}}{4}$

5. Which absolute value inequality is equivalent to the solution shown by the number line graph?

   (A) $|5 - x| < 1$ (B) $|x + 5| > 1$
   (C) $|x - 5| < 2$ (D) $|x + 5| > 2$
   (E) $|x - 5| > 2$

6. The equation $x - \sqrt{x^2 + 15} = -3$ has

   (A) no real solutions (B) two positive solutions (C) two negative solutions
   (D) exactly one positive solution (E) exactly one negative solution

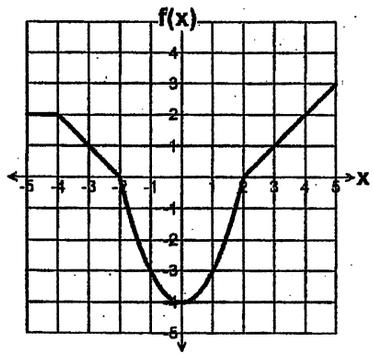
7. What are all the values of x for which $(x + 1)(x + 5)$ is negative?

   (A) $x < -5$ or $x > -1$ (B) $-5 < x < -1$ (C) $x < -5$
   (D) $x < -1$ (E) $x > -5$ or $x < -1$

8. What is the simplified form of $\left(5\sqrt[3]{-32AB^2}\right)\left(2\sqrt[3]{\frac{1}{2}A^2B}\right)$?

   (A) $20A^3B^3$ (B) $10\sqrt[6]{-16A^3B^3}$ (C) $-20AB\sqrt[3]{2}$ (D) $40AB\sqrt[3]{AB}$ (E) $-20AB\sqrt{2}$

OVER



9. The figure above shows the graph of function f. What is the range of function f?

(A) $f(x) \leq 3$ (B) $0 \leq f(x) \leq 3$ (C) $-4 \leq f(x) \leq 3$

(D) $-5 \leq f(x) \leq 5$ (E) all real numbers

10. The product of $(3 + 2i^7)$ and $(7 + 6i^5)$ is

(A) $21 - 12i$ (B) $33 + 4i$ (C) $9 + 4i$ (D) $21 + 16i$ (E) $10+8i$

11. If the sum of the roots of the equation $x^2 + kx - 3 = 0$ is equal to the product of the roots, the value of k is

(A) -6 (B) -3 (C) 3 (D) 6 (E) 1

12. The expression $\frac{1}{2}\log a - 2\log b$ is equivalent to

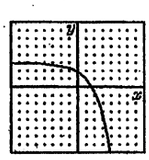
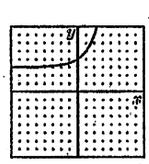
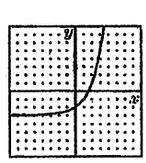
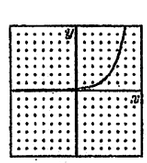
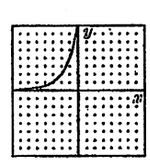
(A) $\log \frac{\sqrt{a}}{b^2}$ (B) $\log \sqrt{ab}$ (C) $\log \frac{a^2}{\sqrt{b}}$ (D) $\log(\sqrt{a} - b^2)$ (E) $\log(\frac{a}{2} - 2b)$

13. If $3^{2x-1} = (\frac{1}{9})^2$, then what is the value of x?

(A) $-\frac{3}{2}$ (B) $-\frac{5}{3}$ (C) $-\frac{2}{3}$ (D) $-\frac{3}{5}$

(E) no solution

14. Which one of the following sketches is a reasonable graph of $y = 2^x + 3$?

(A)  (B)  (C)  (D)  (E) 

15. If $f(x) = 5x - 2$ and $g(x) = 2 - x$, what is the value of $g(f(x - 2))$?

(A) $18 - 5x$ (B) $5x - 14$ (C) $5x - 8$ (D) $14 - 5x$ (E) $5x - 18$

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PART II: Select TWO of the following three problems, and answer both parts, (a) and (b), of each. Use the provided space to show your work. [20 points each]

1. a) Solve for x:

$$\frac{x}{x+4}+\frac{4}{x-2}=\frac{8-4x}{x^2+2x-8}$$

b) Solve for x:

$$|4x-9|-5x=4$$

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2. a) Combine rational expressions and express in simplest form:

$$\frac{8}{x^2+2x-15}-\frac{3}{x^2-3x}$$

b) Find the solution set and express your answer using set-builder notation:

$$\frac{(x-1)^2(x-2)}{x-3}\leq 0$$

3. a) Solve for x:

$$\log_3(2x+3)+\log_3(x-2)=2$$

b) The amount, A, in grams, of the radioactive isotope hydrogen-3 remaining after t years fits the model: $A(t)=600e^{rt}$. Given the table below, if 100 grams remain after 32 years, find the annual rate, r, of the element's decay. Express your answer as a percentage.

ln 1	ln 2	ln 3	ln 4	ln 5	ln 6	ln 7	ln 8	ln 9	ln 10
0	0.693	1.099	1.386	1.609	1.792	1.946	2.079	2.197	2.303