Name_____ **Date**_____

Directions: Complete as many problems as you can in the 30 minutes allotted to you. No calculators!

1. If $\dfrac{\left(x^3 - y^3\right)\sqrt{r^2 - 6}}{\frac{5}{4}} = \dfrac{4}{5}(r - 3q)\left(x^3 - y^3\right)$, find the value of $q(9q - 6r) + 3$.

   (A) −4   (B) −3   (C) −2   (D) −1   (E) 1

2. Evaluate $\dfrac{m^{j+k+l+h} + 3m^{j+k}}{m^{k+l+h} + 3m^{k}}$ if $m = 2$, $j = 3$, and $k = 2$.

   (A) 4   (B) 6   (C) 8   (D) 16   (E) 32

3. Aubrey had $9p$ dimes and Grace had $3p$ nickels. How much more money did Aubrey have than Grace?

   (A) $12p$ (B) $24p$ (C) $48p$ (D) $64p$ (E) $75p$

4. If $-6\left(\dfrac{x}{y}\right)^2 - 6\left(\dfrac{x}{y}\right) + 180 = 0$, what is the largest value that $\dfrac{x}{y}$ could have?

   (A) 2   (B) 3   (C) 4   (D) 5   (E) 6

5. If $7x^2 = 20xy + 3y^2 + 3$, find the value of $\left[\dfrac{(7x + y)(x - 3y) + 6}{3} - 5\right]^3$.

   (A) −125   (B) −64   (C) −27   (D) −8   (E) −6

6. If $\dfrac{T}{Q} - 3 + \sqrt{R} = 3T - Q$ where Q, C, and R are positive, then simplify $\left(\dfrac{CT}{Q} - 5C + C\sqrt{R}\right) - (3T - 4 - Q)C$

   (A) −9C   (B) −C   (C) C   (D) 2C   (E) 3C

7. For $-3\left[-2(a + b) + 6\right] < -36$, which of the following best describes a?

   (A) $a < -7 - b$ (B) $a > -7 - b$ (C) $a > -4 - b$ (D) $a > -3 - b$ (E) $a < -3 - b$

8. If $x^2 + 4x + 7$ is an even number, which of the following must be an odd number?

   (A) $3x^2 - 5x - 33 + 9x - 2x^2$ (B) $x^2 + x + 60 + 3x - 9$ (C) $6x^2 - 2x - 80 + 6x - 5x^2$
   (D) $x^2 - 10x - 17 + 14x + 46$ (E) $10x^2 + 4x - 25 - 9x^2 - 40$

9. In x more years, you will be $\dfrac{17}{4}x + 1$ years old. How old were you $\dfrac{3}{4}x - 2$ years ago?

   (A) $\dfrac{5}{2}x - 1$ (B) $\dfrac{5}{2}x + 3$ (C) $\dfrac{7}{2}x - 1$ (D) $\dfrac{7}{2}x + 3$ (E) $4x - 1$

10. $\left(-4x^3 + 6x^3\right)\left(-4x^3 - 6x^3\right) =$

    (A) $-20x^3$ (B) $-20x^6$ (C) $-20x^9$ (D) $-20x^{12}$ (E) $-20x^{36}$

11. If $\dfrac{wy}{xz} + \dfrac{wv}{xt} - \dfrac{py}{rz} - \dfrac{pv}{rt} - 2 = -14$ and $\dfrac{y}{z} + \dfrac{v}{t} = -4$, find the value of $\dfrac{w}{x} - \dfrac{p}{r} - \left(\dfrac{y}{z} + \dfrac{v}{t}\right)$.

    (A) −1   (B) 0   (C) 1   (D) 7   (E) 8

12. If $24 - 3\sqrt[5]{\dfrac{a + b}{c}} = 6 - 6\sqrt[5]{\dfrac{a + b}{c}}$, find $\dfrac{2}{3}\sqrt[5]{\dfrac{a + b}{c}} + 3$

    (A) −1   (B) 1   (C) 2   (D) 3   (E) 7

13. You studied for 20 minutes for a quiz and got 16 correct. How many questions would you get correct if you studied for 30 minutes? Assume the amount of time studying is directly proportional to the number of questions that you get correct.

   (A) 18   (B) 20   (C) 22   (D) 24   (E) 25

14. For $y = \sqrt{3}x^2 + 6\sqrt{15}x - \sqrt[3]{17} + \sqrt[4]{29}$, which equation is the axis of symmetry?

(A) $x = -3\sqrt{5}$ (B) $x = -5\sqrt{3}$ (C) $x = 5\sqrt{3}$ (D) $x = 3\sqrt{5}$ (E) $x = \sqrt{3}\sqrt{5} - \sqrt[3]{17} + \sqrt[4]{29}$

15. If $\begin{cases} x + y = -2 \\ y - z = 7 \\ z - x = -3 \end{cases}$, find the value of $\dfrac{x+z}{3}$.

(A) -3 (B) -2 (C) -1 (D) 1 (E) 2

16. Which of the following is true?

    I. $4,111°$ II. $\dfrac{137\pi}{6}$ radians   III. 66 radians

(A) $\text{I} < \text{II} < \text{III}$ (B) $\text{II} < \text{I} < \text{III}$ (C) $\text{II} < \text{III} < \text{I}$ (D) $\text{III} < \text{I} < \text{II}$ (E) $\text{III} < \text{II} < \text{I}$

17. If $a + 3 = \dfrac{-\cos(x+y)\tan x - \cos(x+y)\tan y}{\sin(x+y)} - \tan x \tan y$, find the value of $a - 6$.

(A) -7 (B) -5 (C) -1 (D) -10 (E) 5

18. $\dfrac{4}{3}\cos(-x)\sin y - \dfrac{2}{3}\sin(x+y)$ is equivalent to which of the following?

(A) $-\dfrac{2}{3}\sin(x-y)$ (B) $\dfrac{2}{3}\sin(x-y)$ (C) $\dfrac{1}{3}\sin(x-y)$ (D) $-\dfrac{1}{3}\sin(x-y)$ (E) $-\dfrac{4}{3}\sin(x-y)$

19. $-2\sin 32° \cdot \sin(-14)° \cdot \sqrt{3}\tan 30° + 4\cos 46° \cdot \cos^2 60°$ is equivalent to which of the following?

(A) $\cos 17°$ (B) $\cos 18°$ (C) $\cos 19°$ (D) $\cos 20°$ (E) $\cos 21°$

20. $\dfrac{5}{3\csc\left(\dfrac{\pi}{2} - \dfrac{t+w}{2}\right)} \cdot \dfrac{\cos 180°}{\sec\dfrac{w-t}{2}} + \dfrac{5}{6}\cos w$ is equivalent to which of the following?

(A) $-\dfrac{5}{6}\cos t$ (B) $\dfrac{5}{3}\cos t$ (C) $\dfrac{10}{3}\cos t$ (D) $\dfrac{5}{6}\cos t$ (E) $-\dfrac{10}{3}\cos t$

21. Simplify $-25f^6 + 7f^3 e^4 - 8e^8 - \dfrac{27f^9 + 64e^{12}}{3f^3 + 4e^4}$

(A) $-14f^6 - 5f^3 e^4 + 8e^8$ (B) $-34f^6 - 5f^3 e^4 - 24e^8$ (C) $-16f^6 + 19f^3 e^4 - 24e^8$
(D) $-16f^6 - 5f^3 e^4 + 8e^8$ (E) $-34f^6 + 19f^3 e^4 - 24e^8$

22. If $v - 12 = 4\sqrt{v}$, Which of the following is a value of $\sqrt{\sqrt{v} + 3}$?
(A) 2 (B) 3 (C) 4 (D) 5 (E) 6

23. Solve $\log_{\frac{1}{64}}\left(2x^3 + 3x^2\right) - \log_{\frac{1}{64}} 5x = -\dfrac{1}{3}$.

(A) 0 (B) 2 (C) 4 (D) -4 (E) $\dfrac{5}{2}$

24. You added up the first j natural numbers and got 36,046. Which of the following is equivalent to j?

(A) $\dfrac{1 \pm \sqrt{1 - 4(-72,092)}}{2}$ (B) $\dfrac{-1 \pm \sqrt{1 - 4(-36,046)}}{2}$ (C) $\dfrac{-1 \pm \sqrt{1 - 4(-72,092)}}{2}$

(D) $\dfrac{1 \pm \sqrt{1 - 4(72,092)}}{-2}$ (E) $\dfrac{1 \pm \sqrt{1 - 4(36,046)}}{2}$

25. X travels a total distance of 80 inches. Every second, it travels one-fourth the distance it traveled the previous second. How many inches will it travel the first two seconds if it travels forever?
(A) 60 (B) 63 (C) 70 (D) 72 (E) 75

1. B	2. C	3. E	4. D	5. D
6. D	7. E	8. C	9. B	10. B
11. D	12. A	13. D	14. A	15. A
16. E	17. D	18. A	19. B	20. A
21. E	22. B	23. E	24. C	25. E

1. $-6 = -6rq + 9q^2 \rightarrow -3$

2. $\dfrac{m^{j+k}\left(m^{l+h}+3\right)}{m^{k}\left(m^{l+h}+3\right)} = m^{j} = 8$

3. $90p - 15p = 75p$

4. $\dfrac{x}{y} = 5$

5. $\left(\dfrac{3+6}{3} - 5\right)^{3} = -8$

6. $\left(\dfrac{CT}{Q} - 5C + C\sqrt{R}\right) - (3T - 4 - Q)C = -2c + 4c = 2c$

7. $a + b < -3 \rightarrow a < -3 - b$

8. $6x^2 - 2x - 80 + 6x - 5x^2$

9. $\dfrac{17}{4}x + 1 - x - \dfrac{3}{4}x + 2 = \dfrac{5}{2}x + 3$

10. $-20x^6$

11. $3 - -4 = 7$

12. $3x = -18 \rightarrow -4 + 3 = -1$

13. $\dfrac{20}{16} = \dfrac{30}{x} \rightarrow x = 24$

14. $y = \sqrt{3}\left(x + 3\sqrt{5}\right)^{2} \dots \rightarrow x = -3\sqrt{5}$

15. $\dfrac{-3-6}{3} = -3$ 16. $\dfrac{137\pi}{6} \cdot \dfrac{180°}{\pi} = 4110° \rightarrow \dfrac{137\pi}{6} = 22\dfrac{5}{6}\pi$ radians, which is less than 66 radians. Therefore III < II < I

17.
$a - 6 = (a+3) - 9 = \dfrac{-\cos(x+y)(\tan x + \tan y)}{\sin(x+y)} - \tan x \tan y - 9 = -\cot(x+y)\left[\tan(x+y)(1-\tan x \tan y)\right] - \tan x \tan y - 9 = -1(1 - \tan x \tan y) - \tan x \tan y - 9 = -10$

18. $\dfrac{4}{3} \cdot \dfrac{1}{2}\left[\sin(x+y) - \sin(x-y)\right] - \dfrac{2}{3}\sin(x+y) = \dfrac{2}{3}\sin(x+y) - \dfrac{2}{3}\sin(x-y) - \dfrac{2}{3}\sin(x+y) = -\dfrac{2}{3}\sin(x-y)$

19.
$2\sin 32° \cdot \sin 14° \cdot \sqrt{3} \cdot \dfrac{1}{\sqrt{3}} + 4\cos 46° \cdot \dfrac{1}{4} = -1 \cdot \left[-2\sin\left(\dfrac{46+18}{2}\right)° \sin\left(\dfrac{46-18}{2}\right)°\right] + \cos 46° = -1\left(\cos 46° - \cos 18°\right) + \cos 46° = \cos 18°$

20. $-\dfrac{5}{3}\cos\dfrac{t+w}{2}\cos\dfrac{w-t}{2} + \dfrac{5}{6}\cos w = -\dfrac{5}{3} \cdot \dfrac{1}{2} \cdot \left(2\cos\dfrac{w+t}{2}\cos\dfrac{w-t}{2}\right) + \dfrac{5}{6}\cos w = -\dfrac{5}{6}\left(\cos w + \cos t\right) + \dfrac{5}{6}\cos w = -\dfrac{5}{6}\cos t$

21. $-34f^6 + 19f^3 e^4 - 24e^8$

22. $(x-6)(x+2) = 0 \rightarrow \sqrt{v} = 6 \rightarrow \sqrt{6+3} = 3$

23. $\left(\dfrac{1}{64}\right)^{-\frac{1}{3}} = \dfrac{2x^3 + 3x^2}{5x} \rightarrow 2x^3 + 3x^2 - 20x = 0 \rightarrow x(2x-5)(x+4) = 0 \rightarrow x = 0, -4, \dfrac{5}{2}$ but $x \neq -4$ or 0.

24. $(1+j)\dfrac{j}{2} = 36{,}046 \rightarrow j^2 + j - 72{,}092 = 0 \rightarrow j = \dfrac{-1 \pm \sqrt{1^2 - 4 \cdot 1(-72{,}092)}}{2}$

25. $80 = \dfrac{a_1}{1 - \dfrac{1}{4}} \rightarrow a_1 = 80 \cdot \dfrac{3}{4} = 60 \rightarrow a_2 = 60 \cdot \dfrac{1}{4} = 15 \rightarrow a_1 + a_2 = 60 + 15 = 75$