Understanding Equations Test

Name ______________________________

Understanding Equations **Name** Key

Linear Equations

1. Write the equation of the line that has a slope of $m = -\frac{4}{7}$ that contains the point (2 , 5) in **standard form.**

$4x + 7y = C$

$4(2) + 7(5) = C$

$8 + 35 = C$

1. $4x + 7y = 43$

2. Write the equation of the line that is **perpendicular** to $y = -\frac{4}{9}x + 154$ that contains the point (3 , – 1) in **standard form.** $m_{\perp} = 9/4$

$9x - 4y = C$

$9(3) - 4(-1) = C$

$27 + 4 = C$

2. $9x - 4y = 31$

Writing Step Functions.

3. Write the equation of the step function that contains steps or *treads* that are 7 units **long** and will *rise* 4 units. One step must start at the origin and run along the x-axis of the first quadrant. Be sure to use proper notation $\lfloor\ \rfloor$ or $\lceil\ \rceil$.

3. $y = 4\lfloor \frac{1}{7}x \rfloor$

4. Write the set of floor equations using **phase shifts** and **restricted domains** that create treads and risers with the following characteristics. A set of five steps starting at (1, 3) with a tread of 5 units and then rising 2 units. This would create a set of five treads and four risers. Be sure to use proper notation $\lfloor\ \rfloor$ or $\lceil\ \rceil$.

Equation for tread with restrictions 4. $y - 3 = 2\lfloor \frac{1}{5}(x-1) \rfloor \quad \{1 \le x < 26\}$

Equation for risers with restrictions 4. $x - 6 = 5\lfloor \frac{1}{2}(y-3) \rfloor \quad \{3 < y \le 11\}$

Writing Linear Absolute Value Functions

5. Write an absolute value equation where the line of symmetry is located at y = 4 that has been shifted to the left five units and opens right with an **actual slope** of $\frac{5}{3}$. Be sure to use proper absolute value notation $| \, |$.

5. $x+5 = \frac{3}{5}|y-4|$

6. Write an absolute value equation where the line of symmetry is located at x = –6 that has been shifted up three units and opens down with a slope of $\frac{1}{3}$. Be sure to use proper absolute value notation $| \, |$.

6. $y-3 = \frac{-1}{3}|x+6|$

7. Write an absolute value equation where the line of symmetry is located at y = 5 that has been shifted to the right nine units and opens left with an **actual slope** of $\frac{2}{3}$ Be sure to use proper absolute value notation $| \, |$.

7. $x-9 = \frac{-3}{2}|y-5|$

Writing Parabolic Equations

8. Write a parabolic equation with a vertex at (7 , – 2) that has movement from the vertex as follows. Move right or left three units then down **fifteen** units. Move right or left six units then down **sixty** units. Finally, move right or left nine units from the vertex then down **one hundred thirty five** units. Be sure to use proper $y = a(x-h)^2 + k$

8. $y = \frac{-5}{3}(x-7)^2 - 2$

9. Consider the **standard form** of a parabola $y = Ax^2 + Bx + C$, Find the (h , k) form if the parabola contains the points (4 , 5) , (7 , 11), and (2 , $7\frac{2}{3}$). Hint: Three equations three unknowns, then complete the square.

$16A + 4B + C = 5$ $\quad 2/3$
$49A + 7B + C = 11 \Rightarrow -16/3$
$4A + 2B + C = 7\frac{2}{3}$ $\quad 47/3$

$y = \frac{2}{3}x^2 - \frac{16}{3}x + \frac{47}{3}$

$3y = 2x^2 - 16x + 47$

$3y = 2[x^2 - 8x + 16] + 47 - 32$

$3y = 2(x-4)^2 + 15$

9. $y = \frac{2}{3}(x-4)^2 + 5$

10. Write a parabolic equation where the line of symmetry is located at x =–3 that has been shifted up two units and opens down with a stretch of three times the standard vertical movement. Be sure to use proper $y = a(x - h)^2 + k$

10. $y = -3(x+3)^2 + 2$

11. Write a parabolic equation with a vertex at (2 , – 5) that has movement from the vertex as follows. Move right or left two units then down two units. Move right or left four units then eight units. Finally, move right or left six units from the vertex then down eighteen units. Be sure to use proper $y = a(x - h)^2 + k$

11. $y = -\frac{1}{2}(x-2)^2 - 5$

12. Write a parabolic equation where the line of symmetry is located at y = 6 that has been shifted to the right four units and opens to the left with a stretch of seven times the standard movement. Be sure to use proper $x = a(y - k)^2 + h$

12. $x = -7(y-6)^2 + 4$

13. Write a parabolic equation with a vertex at (1 , 3) that has movement from the vertex as follows. Move up or down three units then left three units. Move up or down six units then left twelve units. Finally, move up or down nine units from the vertex then left twenty seven units. Be sure to use proper $x = a(y - k)^2 + h$

13. $x = -\frac{1}{3}(y-3)^2 + 1$

Writing Equations for Ellipses

14. Use completing the squares techniques to convert this standard form equation into the (h , k) form. $9x^2 - 12x + 64y^2 + 64y - 202 = 354$ Please remember that not all ellipses have lattice points for centers. Additionally a^2 and b^2 are not always the squares of integer values. In other words, sometimes students are expected to work with less than ideal equations.

$9x^2 - 12x \quad + 64y^2 + 64y \quad = 354 + 202$

$9[x^2 - \frac{4}{3}x + \frac{4}{9}] + 64[y^2 + y + \frac{1}{4}] = 556 + 4 + 16$

$\frac{9(x - \frac{2}{3})^2}{576} + \frac{64(y + \frac{1}{2})^2}{576} = \frac{576}{576}$

14. $\frac{(x - \frac{2}{3})^2}{64} + \frac{(y + \frac{1}{2})^2}{9} = 1$

15. Write an elliptical equation with a center at (5 , –4) that has a major axis length of fourteen parallel to the x-axis and a minor axis length of six. Be sure to use proper $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$

↓
HORIZONTAL MAJOR AXIS LENGTH 14 ⇒ a=7

MINOR AXIS LENGTH 6 ⇒ b=3

15. $\frac{(x-5)^2}{49} + \frac{(y+4)^2}{9} = 1$

16. Write an elliptical equation with a center at (–2 , 7) that has a major axis length of thirty four parallel to the y-axis and a minor axis length of twenty. Be sure to use proper $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$

↓
VERTICAL

MAJOR AXIS LENGTH 34 ⇒ b=17

MINOR AXIS LENGTH 20 ⇒ a= 10

16. $\frac{(x+2)^2}{100} + \frac{(y-7)^2}{289} = 1$

Writing Equations for Circles

17. Use completing the squares techniques to convert this standard form equation into the (h , k) form. $225x^2 - 150x + 225y^2 - 360y - 56 = 1800$ Please remember that not all circles have lattice points for centers. Additionally r^2 does not always represent the square of an integer value. In other words, sometimes students are expected to work with less than ideal equations.

$225[x^2 - \frac{2}{3}x + \frac{1}{9}] + 225[y^2 - \frac{8}{5}y + \frac{16}{25}] = 1856 + 25 + 144$

$\frac{225(x - \frac{1}{3})^2}{225} + \frac{225(y - \frac{4}{5})^2}{225} = \frac{2025}{225}$

17. $(x - \frac{1}{3})^2 + (y - \frac{4}{5})^2 = 9$

18. Write the equation of the circle with a center at (4 , – 7) and a radius of length nine. Be sure to use proper $(x-h)^2 + (y-k)^2 = r^2$

18. $(x-4)^2 + (y+7)^2 = 81$

☆ 19. Consider the **general form** of a circle $x^2 + Ax + y^2 + By + C = 0$, Find the (h , k) form if the circle contains the points ($4\frac{2}{5}$, $3\frac{1}{4}$), (6 , 9), and (3 , 8). Hint: Three equations three unknowns, then complete the squares.

19. $(x-5.301)^2 + (y-6.097)^2 = 8.917$

Writing Equations of Hyperbolas

20. Write the equation of the horizontal hyperbola with a center at (–4 , –8) with slant asymptotes with slopes of $\frac{3}{5}$ and $-\frac{3}{5}$.

20. $\frac{(x+4)^2}{25} - \frac{(y+8)^2}{9} = 1$

21. Write the equation of the vertical hyperbola with a center at (7 , –3) with slant asymptotes with slopes of $\frac{7}{2}$ and $-\frac{7}{2}$.

21. $\frac{(y+3)^2}{49} - \frac{(x-7)^2}{4} = 1$

ELLIPSE 22. Use completing the squares techniques to convert this standard form equation into the (h , k) form. $25x^2 - 100x + 4y^2 + 24y + 20 = -16$ Please remember that not all hyperbolas have lattice points for centers. Additionally a^2 and b^2 are not always the squares of integer values. In other words, sometimes students are expected to work with less than ideal equations.

$25[x^2-4x+4] + 4[y^2+6y+9] = -36 +100 +36$

$\frac{25(x-2)^2}{100} + \frac{4(y+3)^2}{100} = \frac{100}{100}$

22. $\frac{(x-2)^2}{4} + \frac{(y+3)^2}{25} = 1$

Writing Equations of Trig Equations

23. Write the equation of a sine function that has an amplitude of five and a period of three that was been shifted four units up and three units to the left.

$WL = \frac{2\pi}{c}$

$3 = \frac{2\pi}{c}$

$c = 2\pi/3$

23. $y = 5 \sin[2\pi/3(x+3)] + 4$

24. Write the equation of a cosine function that has an amplitude of $\frac{1}{2}$ and a period of $\frac{\pi}{3}$ that was been shifted three units down and four units to the right.

$WL = \frac{2\pi}{c}$

$\frac{\pi}{3} = \frac{2\pi}{c}$

$c = \frac{2\pi}{\pi/3}$

$c = 6$

24. $y = \frac{1}{2} \cos[6(x-4)] - 3$

#19 CONSIDER

$(6,9)$: $36 + 6A + 81 + 9B + C = 0$

$6A + 9B + C = -117$

$(3,8)$: $9 + 3A + 64 + 8B + C = 0$

$3A + 8B + C = -73$

$\left(4\tfrac{2}{5}, 3\tfrac{1}{4}\right)$ $\frac{484}{25} + \frac{22}{5}A + \frac{169}{16} + \frac{13}{4}B + C = 0$

$\frac{22}{5}A + \frac{13}{4}B + C = \frac{-11{,}969}{400}$

$$\begin{bmatrix} -66{,}369/6260 \\ -76{,}333/6260 \\ 352{,}791/6260 \end{bmatrix}$$

$$x^2 - \frac{66{,}369}{6260}x + y^2 - \frac{76{,}333}{6260}y + \frac{352{,}791}{6260} = 0$$

$6260x^2 - 66{,}369x + 6260y^2 - 76{,}333y + 352{,}791 = 0$: MULTIPLIED BY 6260

$$\left[x^2 - 10.602x + 28.101\right] + \left[y^2 - 12.194y + 37.172\right] = -56.356 + 28.101 + 37.172$$

$$(x - 5.301)^2 + (y - 6.097)^2 = 8.917$$

25. Write the equation of a cosine function that has an amplitude of 5 and a period of $\frac{\pi}{4}$ that was been shifted two units down and three units to the right.

$WL = \frac{2\pi}{c}$

$\frac{\pi}{4} = \frac{2\pi}{c}$

$c = 2\pi / \pi/4$

$c = 8$

25. $y = 5\cos[8(x-3)] - 2$

Even, Odd or Neither Functions

26. $r(x) = \frac{1}{2}x^2 - 3$ — 26. EVEN

27. $m(x) = x^3 - 5x^2 + 2x$ — 27. NEITHER

28. $q(x) = -\frac{3}{5}x$ — 28. ODD

29. $s(x) = 3\cos(2x) + 5$ — 29. EVEN

30. $c(x) = x^4 - 4x$ — 30. NEITHER

31. $f(x) = |7x| + 5$ — 31. EVEN

32. $w(x) = 4x - 3$ — 32. NEITHER

33. $y(x) = 2\sin(\pi x) + 1$ — 33. NEITHER

34. $p(x) = x^5 - 4x^2$ — 34. NEITHER

35. $e(x) = |x - 3| + 1$ — 35. NEITHER