PART 1 - Machine Scored

Answers are on the back page

1. A function $f(x)$ is reflected about the line $x = 0$, and is horizontally translated 3 units to the left. The equation of the transformed function, in terms of f, is:

A. $y = -f(x+3)$ **B.** $y = -f(x-3)$ **C.** $y = f(-x+3)$ **D.** $y = f(-x-3)$

NR #1

A rational function $f(x) = \sqrt{x+3} - 1$ is transformed into the graph $g(x) = f(x+2) + k$.

The graph of $y = g(x)$ will have a domain of $x \geq$ _____ and a range $y \geq$ _____
first digit *second digit*

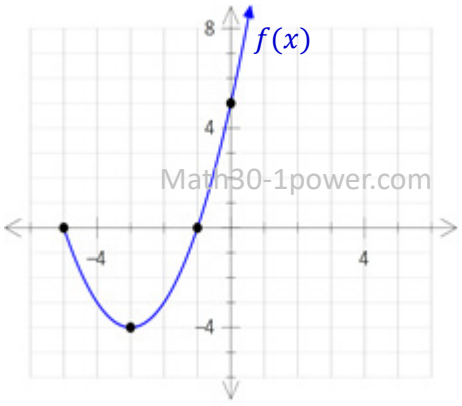
Use the following codes (in bold) to complete the sentence above:

1 1 **2** k **3** -1 **4** $k-1$ **5** 5 **6** -2 **7** -3 **8** $-1-k$ **9** -5

Use the following information to answer questions 2, 3, and 4.

The graph of $y = f(x)$, shown on the right is transformed to two functions $g(x)$ and $h(x)$, defined below:

- $g(x) = -2f(x) + 1$
- $h(x) = f\left(\frac{1}{2}x - 2\right)$



2. The range of $y = g(x)$ is

A. $(-\infty, 9]$ **B.** $[9, \infty)$ **C.** $(-\infty, 7]$ **D.** $[7, \infty)$

3. The domain of $y = h(x)$ is

A. $\{x | x \geq 1.5, x \in \mathbb{R}\}$ **B.** $\{x | x \geq -0.5, x \in \mathbb{R}\}$ **C.** $\{x | x \geq -6, x \in \mathbb{R}\}$ **D.** $\{x | x \geq -8, x \in \mathbb{R}\}$

4. The largest positive x-intercept on the graph of $y = h(x)$ is at x equal to

A. 1.5 **B.** 3.5 **C.** 0 **D.** 2

NR #2

A function $y = 2x^2 + 1$ is vertically stretched by a factor of 3, and vertically translated 2 units up. The resulting equation has the form $y = ax^2 + b$, where $a =$_____ and $b =$_____.
first digit *second digit*

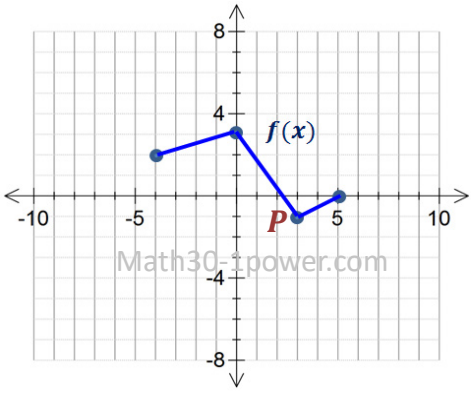
Use the following information to answer NR #3 and questions 5 and 6

The graph of $y = f(x)$ is shown. A point P on the graph of $y = f(x)$ has coordinates $(3, -1)$.

Jagmeet sketches the graph of $h(x) = 4f(-x) - 3$

and

Brian sketches the graph of $k(x)$, obtained by transforming $f(x)$ with a horizontal stretch by a factor of 3, and a horizontal translation 9 units right.



Use the following codes (in bold) to complete the sentence below:

1 1 **2** -7 **3** -5 **4** 4 **5** -8 **6** -1 **7** 7 **8** 12 **9** 9

NR #3

The graph of $y = h(x)$ has a domain $[a, b]$ and a range $[c, d]$ where the value of a is _____, b is _____, c is _____, and d is _____.
first digit *second digit* *third digit* *fourthdigit*

5. Once transformed to the graph of $y = k(x)$, the coordinates of P are $(m, -1)$, where m is equal to

A. 0 **B.** 4 **C.** 10 **D.** 18

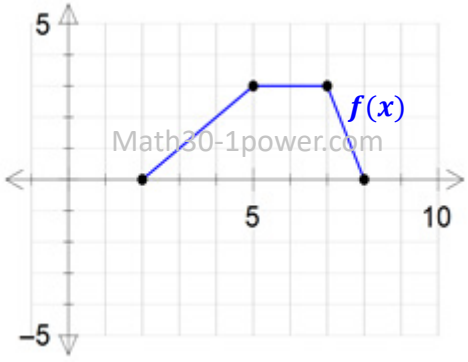
6. An equation for $k(x)$, in terms of $f(x)$, is

A. $k(x) = f[3(x-9)]$ **B.** $k(x) = f\left[\frac{1}{3}(x-9)\right]$ **C.** $k(x) = f\left[\frac{1}{3}(x-3)\right]$ **D.** $k(x) = f[3(x-3)]$

7. The graph of $f(x) = \sqrt{x-9}$ is transformed to beome the graph of $y = g(x)$, such that a point (x, y) on the graph of $f(x)$ is mapped to $(3x-6, -y+1)$ on the graph of $g(x)$. The domain of $y = g(x)$ is

A. $[5, \infty)$ **B.** $[9, \infty)$ **C.** $[21, \infty)$ **D.** $[27, \infty)$

Use the following information to answer question 8



The graph of a function $f(x)$ is shown on the left.

The graph of $f(x)$ is transformed to $g(x) = af(bx) + k$ such that

- the domain of $g(x)$ is $[0.5, 2]$, and,
- the range of $g(x)$ is [2, 11].

8. An equation of $g(x)$, in terms of $f(x)$ is:

A. $g(x) = 3f(4x) + 2$ **C.** $g(x) = 3f(0.25x) + 2$

B. $g(x) = 2f(4x) + 5$ **D.** $g(x) = 2f(0.25x) + 5$

9. The graph of $f(x) = 2x^2 - 3x + 5$ is vertically reflected about the line $y = 0$ and horizontally reflected about the line $x = 0$ to become $y = g(x)$. An equation for the transformed function is

A. $g(x) = -2x^2 - 3x - 5$

B. $g(x) = 2x^2 - 3x - 5$

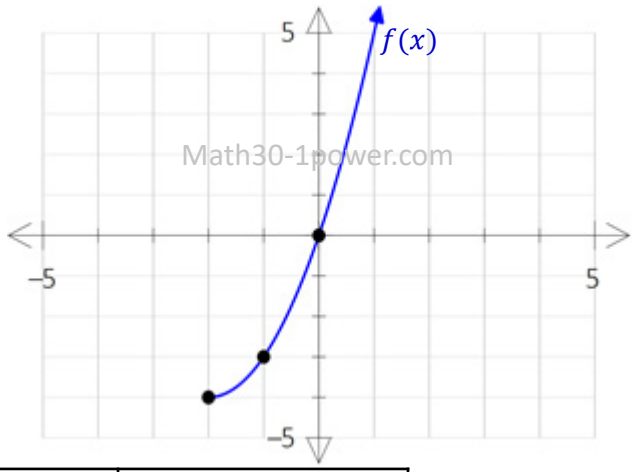
C. $g(x) = -2x^2 - 3x + 5$

D. $g(x) = 2x^2 - 3x + 5$

Use the following information to answer NR #4

The graph of $y = f(x)$, shown on the right is transformed to two functions $g(x)$ and $h(x)$, defined below:

- $g(x) = \frac{3}{2}f[-(x+2)] + 2$
- $h(x) = f^{-1}(x)$



The domain and range of each of the new functions are found in the table below.

Reference Number	Possible Domain
1	$x \leq 0, x \in \mathbb{R}$
2	$x \geq 0, x \in \mathbb{R}$
3	$x \leq 4, x \in \mathbb{R}$
4	$x \geq 4, x \in \mathbb{R}$
5	$x \geq -4, x \in \mathbb{R}$

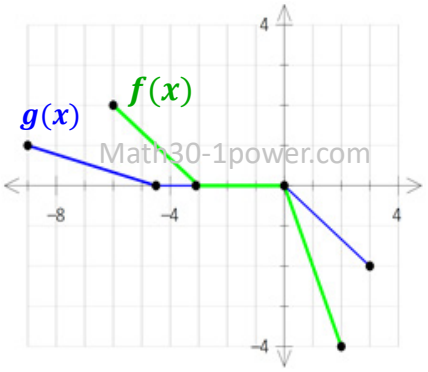
Reference Number	Possible Range
6	$y \geq -8, y \in \mathbb{R}$
7	$y \geq -4, y \in \mathbb{R}$
8	$y \geq -2, y \in \mathbb{R}$
9	$y \geq -2/3, y \in \mathbb{R}$

NR #4

The domain and range of $g(x)$ are numbered, respectively ____ and ____.
first digit *second digit*

The domain and range of $h(x)$ are numbered, respectively ____ and ____.
third digit *fourth digit*

Use the following information to answer question NR #5



The graphs of the functions $f(x)$ and $g(x)$ are shown on the right.

The graph of $g(x)$ is obtained by vertically and horizontally stretching the graph of $f(x)$, such that

$$g(x) = af(bx)$$

Where a can be written in the simplifed form $\frac{m}{n}$

And b can be written in the simplifed form $\frac{p}{q}$

NR #5

The values of m, n, p and q are, respectively _____ , _____ , _____ , and _____.
first digit *second digit* *third digit* *fourth digit*

10. The graph of $f(x) = 2x^2 + 3x - 5$ is transformed to $y = g(x)$ by applying a vertical reflection about the line $y = 0$ and horizontally translating 1 unit left. The simplified equation of $g(x)$ is

A. $g(x) = -2x^2 + 7x - 10$

B. $g(x) = -2x^2 - 7x$

C. $g(x) = -2x^2 - x - 4$

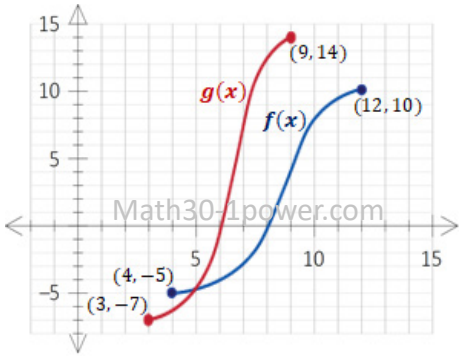
D. $g(x) = -2x^2 + x + 6$

Use the following information to answer NR #6

The graphs of two functions are shown on the right.
The graph of $g(x)$ is a transformation of $f(x)$ such that

$$g(x) = af(bx)$$

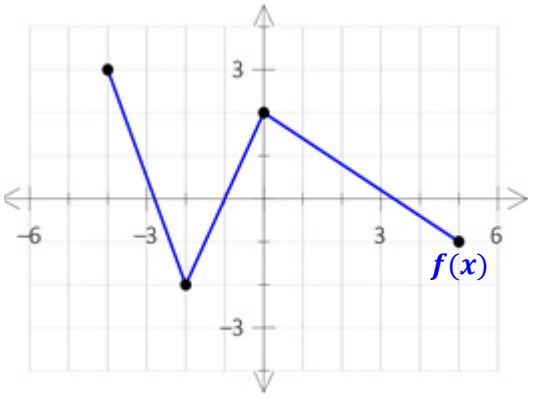
Correct to the nearest tenth, the value of a can be written as $a.b$ (first two digits of your answer), and the value of b can be written as $c.d$ (last two digits of your answer).



NR #6

The values of a, b, c, and d are, respectively: _____, _____, _____, and _____.

Use the following information to answer NR #7



The graph of a function $f(x)$ is shown on the right.

The graph of $g(x)$ is obtained by reflecting the graph of $f(x)$ about the line $y = x$.

NR #7

Complete the statements below.

When the graph of $y = f(x)$ is reflected about the line $y = x$ there will be _____ invariant points.
first digit

The number of y-intercepts on the graph of $y = g(x)$ is _____ .
second digit

The largest x-coordinate on the graph of $y = g(x)$ will be _____.
third digit

Use the following information to answer questions 11 and 12

A function $g(x)$ is defined as the inverse of $f(x) = \sqrt{x+4} - 1$.

11. An equation for $y = g(x)$ is:

A. $g(x) = (x+1)^2 + 4$

B. $g(x) = (x+1)^2 - 4$

C. $g(x) = (x-1)^2 + 4$

D. $g(x) = (x-1)^2 - 4$

12. The domain of $y = g(x)$ and its y-intercept are, respectively

A. $[-1, \infty)$, $y = -3$

B. $[-1, \infty)$, $y = 2$

C. $(-\infty, \infty)$, $y = -3$

D. $(-\infty, \infty)$, $y = 2$

PART 2 - Written Response

Use the following information to answer the first part of WR 1

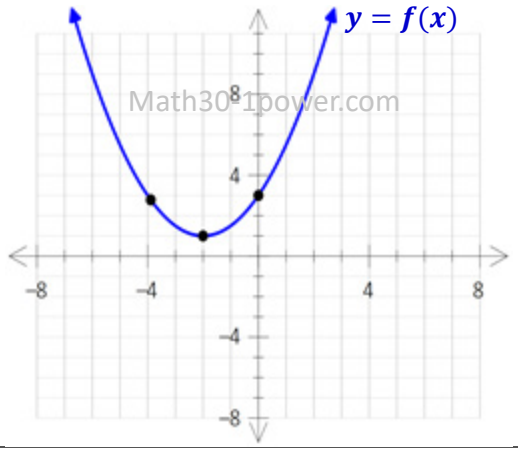
The graph of $f(x)$, shown on the right, has an equation which can be written in the form:

$$f(x) = a(x-h)^2+k$$

where h and k are the coordinates of the vertex. The graph of $f(x)$ passes through the points $(-4, 3)$, $(-2, 1)$ and $(0, 3)$.

The graph of $f(x)$ has the following transformations applied in determining a new function, $g(x)$.

- Vertical stretch about the x-axis by a factor of 3
- Horizontal translation 4 units right



WR Question 1

(a) On the same grid above, **sketch** the graph of $y = g(x)$, indicated all revevant details including the transformations of the indicated points.

(b) **Algebraically determine** the equation of both $y = f(x)$ and $y = g(x)$, in the form $f(x) = a(x-h)^2+k$ and $g(x) = a(x-h)^2+k$

(c) **Explain** how a reflection can affect the graph of $f(x)$ equivalently to horizontally tranlating 4 units right. Justify your answer. **Note:** This is a ***bonus part***, on the diploma exam each WR question has exactly two parts!

(d) A function $h(x)$ is obtained by reflecting $y = f(x)$ about the line $y = x$. **Sketch** the graph of $y = h(x)$ and **determine** an equation. **Note:** This is ANOTHER ***bonus part***, for your enjoyment!

Use the following information to answer the first part of WR #1

The table below represents three separate sets of transformations. In each case, and original function $f(x)$ has at least one specific transformations applied, such that a resulting function $g(x)$ is obtained.

Three portions of the table, numbered ❶, ❷, and ❸ are covered up as shown below. Math30-1power.com

-	*First transformation*	*Second transformation*	*Third transformation*
Original Function	$f(x) = 2x^2 + 4x + 8$	$f(x) = \lvert x - 4\rvert + 2$	❸
Mapping Rule	$(x, y) \to (x, \frac{3}{4}y - 6)$	❷	$(x, y) \to (2x, y)$
Transformed Function	❶	$g(x) = -\lvert x - 1\rvert + 2$	$g(x) = \sqrt{3(x-4)}$

WR Question 2

(a) **Determine** the contents of each of the three covered portions in the above table.

Use the following information to answer the second part of WR 1

A column is added to the table to describe fourth transformation in which a function $f(x) = 2(x+3)(x-1)(x-2)$ is transformed to $g(x) = \frac{3}{4}f(-x)$.

(b) Use an algebraic process to determine any x or y-intercepts of $y = g(x)$, and state the range of $y = g(x)$. **Justify** your answers.

Answers For full, worked-out solutions (as well as other practice materials) visit us online

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Part 1 – Machine Scored

1. **D** NR 1 **94** 2. **A** 3. **C** 4. **D** NR 2 **65** NR 3 **3429** 5. **D** 6. **B** 7. **C** 8. **A** 9. **A**
NR 4 **1758** NR 5 **1223** 10. **B** NR 6 **1408** NR 7 **233** 11. **B** 12. **A**

Part 2 – Written Response

1. **(a)** Graph of $g(x)$ goes through $(0, 9)$, $(2, 3)$, and $(4, 9)$ **(b)** Eqns: $f(x) = \frac{1}{2}(x+2)^2 + 1$ $g(x) = \frac{3}{2}(x-2)^2 + 3$
   (c) Show that replacing "x" with "$-x$" in $f(x)$ will also lead to same equation as replacing "x" with "$x + 4$"
   (d) Graph of $h(x)$ goes through $(3, -4)$, $(1, -2)$, and $(3, -4)$ Equation: $h(x) = \pm\sqrt{2(x-1)} - 2$
2. **(a)** ❶ $g(x) = \frac{3}{2}x^2 + 3x$ ❷ mapping rule is $(x, y) \to (x - 3, -y + 4)$ ❸ $f(x) = \sqrt{6(x-2)}$
   (b) x-ints of $g(x)$: $-2, -1$, and 3 y-int of $g(x)$: 36 **RANGE** of $g(x)$: $\{y \in \mathbb{R}\}$