Old vs. New on the ACT

Descriptive Statistics

OLD – December 2001, #29

The median of a set of data containing 9 items was found. Four data items were added to the set. Two of these items were greater than the original median, and the other 2 items were less than the original median. Which of the following statements *must* be true about the median of the new data set?

A. It is the average of the 2 new lower values.
B. It is the same as the original median.
C. It is the average of the 2 new higher values.
D. It is greater than the original median.
E. It is less than the original median.

NEW – April 2018, #56

In a data set of 10 distinct values, the single largest value is replaced with a much greater value to form a new data set. Which of the following statements is true about the values of the mean and median for the new data set as compared to the mean and median of the original data set?

F. The mean will increase; the median will stay the same.
G. The mean will stay the same; the median will increase.
H. The mean and median will both stay the same.
J. The mean and median will both increase.
K. Using the given information, the means and medians of the 2 data sets cannot be compared.

Descriptive Statistics

OLD – December 2001, #29

The median of a set of data containing 9 items was found. Four data items were added to the set. Two of these items were greater than the original median, and the other 2 items were less than the original median. Which of the following statements *must* be true about the median of the new data set?

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E. It is less than the original median.

5,5,5,5,5,5,5,5,5,5

1,2,5,5,5,5,5,5,5,5,5,5,12,88

NEW – April 2018, #56

In a data set of 10 distinct values, the single largest value is replaced with a much greater value to form a new data set. Which of the following statements is true about the values of the mean and median for the new data set as compared to the mean and median of the original data set?

F. The mean will increase; the median will stay the same.
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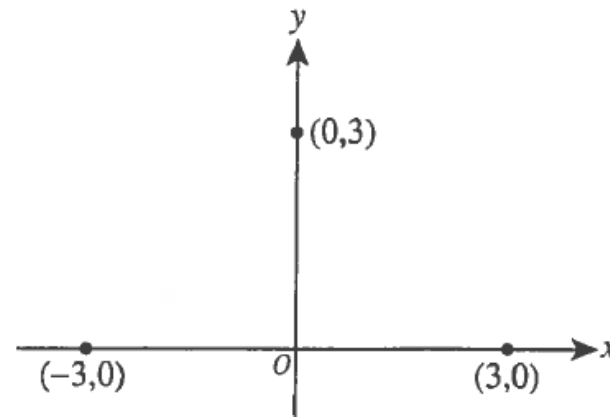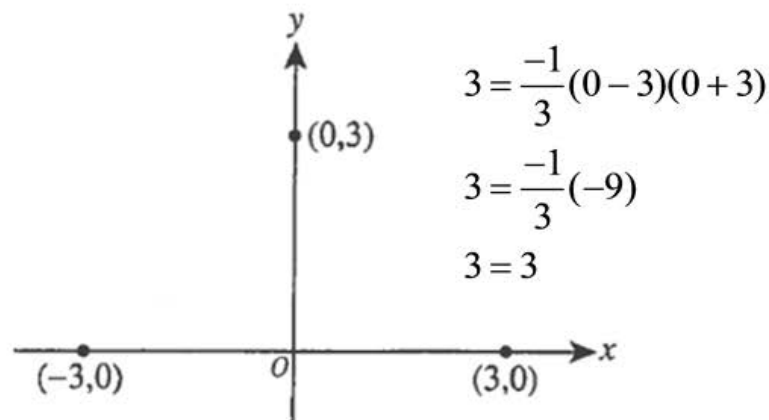1,2,3,4,5,6,7,8,9,10

1,2,3,4,5,6,7,8,9,8888

Quadratics

Which equation below has the solutions $x = p$ and $x = q$?

F. $(x - p)(x - q) = 0$
G. $(x - p)(x - q) = 1$
H. $(x + p)(x + q) = 0$
J. $x + p + q = 0$
K. $x + pq = 0$

Which of the following is an equation of a parabola that passes through the 3 points labeled in the standard (x,y) coordinate plane below?

A. $y = -\frac{1}{3}(x - 3)(x + 3)$

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

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

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

E. $y = \frac{1}{3}(x - 3)(x + 3)$

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Did anyone employ the ACT Strategy – Use Substitution with Ordered Pairs?

OLD – June 2001, #22

NEW – April 2018, #45

Which equation below has the solutions $x = p$ and $x = q$?

$(p - p)(p - q) = 0$

$(0)(p - q) = 0$ ✓

F. $(x - p)(x - q) = 0$
G. $(x - p)(x - q) = 1$
H. $(x + p)(x + q) = 0$
J. $x + p + q = 0$
K. $x + pq = 0$

$(q - p)(q - q) = 0$

$(q - p)(0) = 0$ ✓

Which of the following is an equation of a <u>parabola</u> that passes through the 3 points labeled in the standard (x,y) coordinate plane below?

$3 = \frac{-1}{3}(0 - 3)(0 + 3)$

$3 = \frac{-1}{3}(-9)$

$3 = 3$

A. $y = -\frac{1}{3}(x - 3)(x + 3)$

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

C. $y = -(x - 3)(x + 3)^2$ Not a Parabola!

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

E. $y = \frac{1}{3}(x - 3)(x + 3)$

ACT June 2019

60. What is the matrix product $\begin{bmatrix} 2 & 4 \\ 6 & 5 \end{bmatrix} \begin{bmatrix} a & b \\ c & d \end{bmatrix}$?

F. $\begin{bmatrix} 2a & 4b \\ 6c & 5d \end{bmatrix}$

G. $\begin{bmatrix} (2a+4b) \\ (6c+5d) \end{bmatrix}$

H. $\begin{bmatrix} (2a+6c) & (4b+5d) \end{bmatrix}$

J. $\begin{bmatrix} (2a+6b) & (4a+5b) \\ (2c+6d) & (4c+5d) \end{bmatrix}$

K. $\begin{bmatrix} (2a+4c) & (2b+4d) \\ (6a+5c) & (6b+5d) \end{bmatrix}$

ACT June 2019

59. In the standard (x,y) coordinate plane, what is the y-intercept of the graph of the function $y = f(x)$ defined below?

$$f(x) = \begin{cases} x^2 - 1 & \text{for } x < -3 \\ 2x - 5 & \text{for } -3 \le x \le 2 \\ |x - 3| & \text{for } x > 2 \end{cases}$$

A. −5

B. −3

C. −1

D. 2.5

E. 3

ACT June 2019

54. How many integers between, but not including, 20 and 30 have a prime factorization with exactly 3 factors that are NOT necessarily unique?

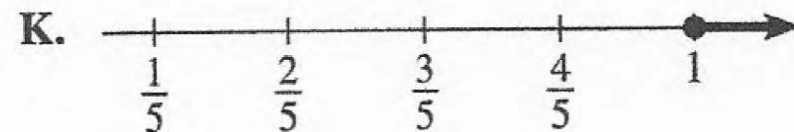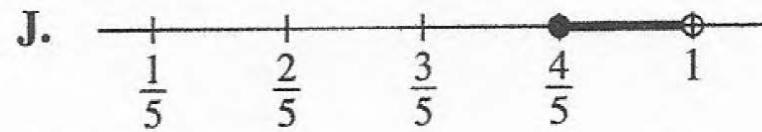(Note: 1 is NOT a prime number.)
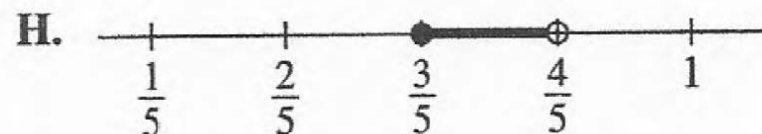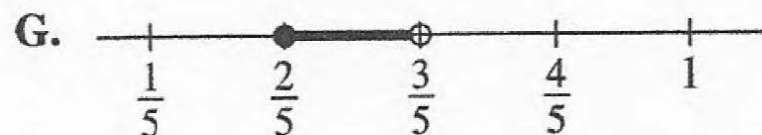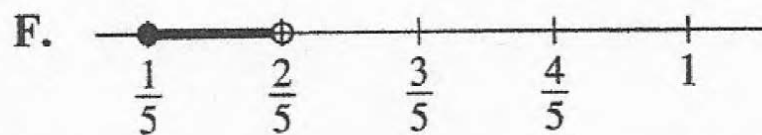
F. 1
G. 2
H. 3
J. 4
K. 5

ACT June 2019

49. What is the solution set of the equation
$x^4 + 21x^2 - 100 = 0$?

    A. $\{-25,\ 4\}$

    B. $\{-25, -2,\ 2\}$

    C. $\{\ -5, -4,\ 5\}$

    D. $\{\ -5,\ 5, -2i, 2i\}$

    E. $\{\ -2,\ 2, -5i, 5i\}$

ACT June 2019

46. The difference $\frac{3}{5} - \frac{-1}{3}$ lies in which of the following intervals graphed on the real number line?

ACT June 2019

45. Florencia has 60 feet of fencing and a 4-foot-wide gate to use to enclose a dog pen. Among the following, a dog pen of which shape and dimensions will have the largest area if only the fencing and the gate are used to enclose it?

- **A.** A square with a side length of 16 feet
- **B.** A square with a side length of 17 feet
- **C.** A rectangle with a length of 14 feet and a width of 16 feet
- **D.** A rectangle with a length of 15 feet and a width of 17 feet
- **E.** A rectangle with a length of 15 feet and a width of 18 feet

ACT June 2019

44. If $49^a = 7$ and $3^{a+b} = 81$, then $b = ?$

    F. $\dfrac{1}{2}$

    G. $\dfrac{3}{2}$

    H. $\dfrac{5}{2}$

    J. 3

    K. $\dfrac{7}{2}$

ACT June 2019

42. Which of the following equations is that of a circle that is in the standard (x,y) coordinate plane, has center $(1,-4)$, and has a radius of 5 coordinate units?

F. $(x-1)+(y+4)=5$

G. $(x+1)+(y-4)=5$

H. $(x-1)^2+(y+4)^2=\sqrt{5}$

J. $(x-1)^2+(y+4)^2=25$

K. $(x+1)^2+(y-4)^2=25$

ACT June 2019

37. Andre's Floral Shop asked each of 20 customers to give a rating of the shop's service. The table below summarizes the 20 customer ratings.

Rating	Number of customers
3	6
2	8
1	2
0	4

Which of the following values is closest to the mean of the 20 customer ratings?

A. 1.8
B. 2.0
C. 2.3
D. 2.7
E. 3.3

ACT June 2019

36. Which of the following arranges the numbers $\frac{9}{5}$, $1.\overline{8}$, 1.08, and $1.\overline{08}$ into ascending order? (Note: The overbar notation shows that the digits under the bar will repeat. For example, $1.\overline{73} = 1.737373\ldots$)

F. $\frac{9}{5} < 1.\overline{08} < 1.08 < 1.\overline{8}$

G. $\frac{9}{5} < 1.08 < 1.\overline{08} < 1.\overline{8}$

H. $1.\overline{08} < 1.08 < \frac{9}{5} < 1.\overline{8}$

J. $1.08 < 1.\overline{08} < 1.\overline{8} < \frac{9}{5}$

K. $1.08 < 1.\overline{08} < \frac{9}{5} < 1.\overline{8}$

ACT June 2019

28. Which of the following expressions is equivalent to $\sqrt[4]{256x^{16}}$?

- **F.** $4x^4$
- **G.** $4x^{12}$
- **H.** $16x^4$
- **J.** $64x^{12}$
- **K.** $128x^8$

ACT June 2019

23. Given that the function f defined as $f(x) = 5 - 3x$ has domain $\{-1, 0, 2\}$, what is the range of f?

A. $\{-2, 0, \ 4\}$

B. $\{-1, 2, \ 8\}$

C. $\{-1, 5, \ 8\}$

D. $\{ \ 2, 5, \ 8\}$

E. $\{ \ 2, 5, 11\}$

ACT June 2019

14. What is the value of the expression $\dfrac{|-3-2|^2+(-1)^3}{16 \div 4 \times 2 - 5}$?

F. -8

G. $-\dfrac{2}{3}$

H. $\dfrac{2}{3}$

J. $\dfrac{26}{3}$

K. 8

ACT June 2019

13. For all x such that $x \neq 0$, which of the following expressions is equivalent to $\dfrac{15x^2 + 25x}{5x}$?

- **A.** $8x$
- **B.** $28x$
- **C.** $3x + 5$
- **D.** $3x^2 + 5$
- **E.** $15x^2 + 5$

Imaginary Numbers

OLD – April 2016, #43

For $i = \sqrt{-1}$, $(1 + 2i)^2 = ?$

A. $-3 + 4i$
B. $2 + 2i$
C. $2 + 4i$
D. -4
E. -3

NEW – June 2017, #58

For all real numbers x and the imaginary number i, which of the following expressions is equivalent to $(x - 3i)^3$?

F. $x^3 - 9x^2i - 27x + 27i$
G. $x^3 + 9x^2i - 27x - 27i$
H. $x^3 + 3x^2i - 9x - 27i$
J. $x^3 - 3x^2i - 9x + 27i$
K. $x^3 + 27i$

Imaginary Numbers

OLD – April 2016, #43

For $i = \sqrt{-1}$, $(1 + 2i)^2 = ?$

Ⓐ $-3 + 4i$
B. $2 + 2i$
C. $2 + 4i$
D. -4
E. -3

$1 + 2i + 2i + 4i^2$

$1 + 4i + 4(-1)$

$-3 + 4i$

NEW – June 2017, #58

For all real numbers x and the imaginary number i, which of the following expressions is equivalent to $(x - 3i)^3$?

F. $x^3 - 9x^2i - 27x + 27i$
G. $x^3 + 9x^2i - 27x - 27i$
H. $x^3 + 3x^2i - 9x - 27i$
J. $x^3 - 3x^2i - 9x + 27i$
K. $x^3 + 27i$

$(x - 3i)(x - 3i)(x - 3i)$

$(x^2 - 6ix + 9i^2)(x - 3i)$

$(x^2 - 6ix - 9)(x - 3i)$

$x^3 - 3ix^2 - 6ix^2 + 18i^2x - 9x + 27i$

$x^3 - 9ix^2 - 27x + 27i$

Proportions

OLD – April 2009, #8

For what value of r is the equation $\frac{8}{12} = \frac{10}{r}$ true?

F.   3
G.   6
H.   14
J.   15
K.   18

NEW – June 2017, #17

What value of x makes the proportion below true?

$$\frac{10}{10+x} = \frac{35}{42}$$

A.   2
B.   7
C.   12
D.   17
E.   32

Proportions

OLD – April 2009, #8

For what value of r is the equation $\frac{8}{12} = \frac{10}{r}$ true?

F. 3
G. 6
H. 14
J. 15
K. 18

$$8r = 120$$

$$r = 15$$

NEW – June 2017, #17

What value of x makes the proportion below true?

$$\frac{10}{10+x} = \frac{35}{42}$$

A. 2
B. 7
C. 12
D. 17
E. 32

$$420 = 35(10+x)$$

$$420 = 350 + 35x$$

$$70 = 35x$$

$$x = 2$$

Substitution

OLD – December 2003, #27

NEW – June 2016, #43

When a bank pays $I\%$ interest, compounded annually, a deposit of $\$P$ increases to $\$P\left(1 + \frac{I}{100}\right)^y$ at the end of y years, where y is a whole number.

Lou initially deposits $\$600$ in an account that pays 4.75% interest, compounded annually. Lou does not make any further deposits or withdrawals. How much money, in dollars, is in Lou's account after 8 years?

A. $6 \cdot (1 + 4.75)^8$

B. $6 \cdot (1 + 0.0475)^8$

C. $600 \cdot (1 + 4.75)^8$

D. $600 \cdot (1 + 0.0475)^8$

E. $600 \cdot (1 + 0.0475) \cdot 8$

To plan orders for a party, a caterer uses the formula $P = \frac{64G}{S}$, where P is the number of people, G is the number of gallons of punch, and S is the size of the cups in ounces. Which of the following gives the number of gallons of punch to order for a party of 200 people when 5-ounce cups will be used?

A. $\frac{(5)(64)}{200}$

B. $\frac{(5)(200)}{64}$

C. $\frac{(64)(200)}{5}$

D. $\frac{64}{(5)(200)}$

E. $\frac{200}{(5)(64)}$

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Substitution

OLD – December 2003, #27

When a bank pays $I\%$ interest, compounded annually, a deposit of $\$P$ increases to $\$P\left(1 + \frac{I}{100}\right)^y$ at the end of y years, where y is a whole number.

Lou initially deposits $600 in an account that pays 4.75% interest, compounded annually. Lou does not make any further deposits or withdrawals. How much money, in dollars, is in Lou's account after 8 years?

A. $6 \cdot (1 + 4.75)^8$
B. $6 \cdot (1 + 0.0475)^8$
C. $600 \cdot (1 + 4.75)^8$
Ⓓ $600 \cdot (1 + 0.0475)^8$
E. $600 \cdot (1 + 0.0475) \cdot 8$

$P = 600$

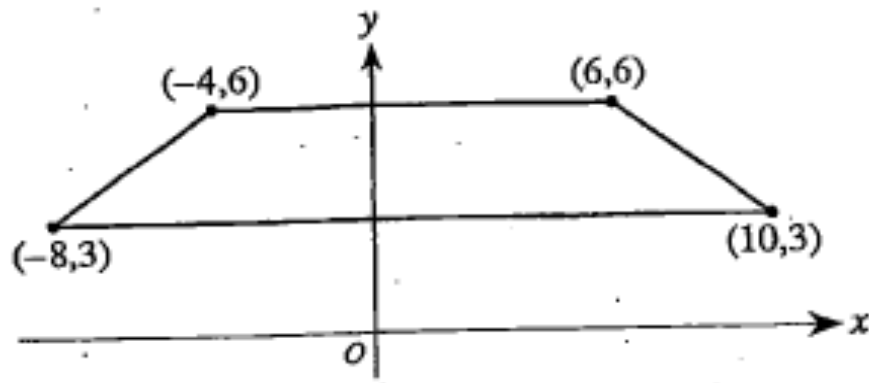$I = 0.0475$

$y = 8$

NEW – June 2016, #43

To plan orders for a party, a caterer uses the formula $P = \frac{64G}{S}$, where P is the number of people, G is the number of gallons of punch, and S is the size of the cups in ounces. Which of the following gives the number of gallons of punch to order for a party of 200 people when 5-ounce cups will be used?

A. $\frac{(5)(64)}{200}$
Ⓑ $\frac{(5)(200)}{64}$
C. $\frac{(64)(200)}{5}$
D. $\frac{64}{(5)(200)}$
E. $\frac{200}{(5)(64)}$

$P = \dfrac{64G}{S}$

$P \cdot S = 64G$

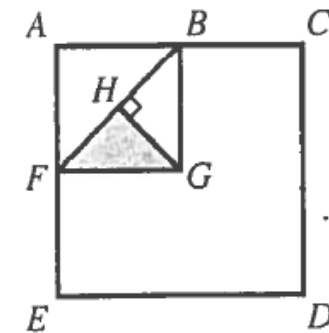$\dfrac{P \cdot S}{64} = G$

Area

The vertices of a trapezoid have the (x,y) coordinates indicated in the figure below. What is the area, in square coordinate units, of the trapezoid?

A. 20
B. 36
C. 38
D. 42
E. 70

In the diagram below, B, F, and H are on $\overline{AC}$, $\overline{AE}$, and $\overline{BF}$, respectively, and $\overline{GH} \perp \overline{BF}$. The area of square $ABGF$ is $\frac{1}{4}$ the area of square $ACDE$. What percent of the area of $ACDE$ does the shaded portion represent?
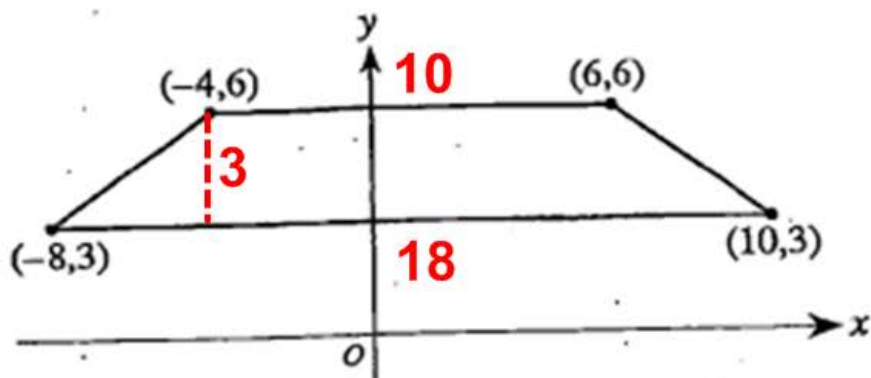
A. 0.0625%
B. 0.125%
C. 0.25%
D. 6.25%
E. 12.5%

Area

OLD – April 2010, #47

The vertices of a trapezoid have the (x,y) coordinates indicated in the figure below. What is the area, in square coordinate units, of the trapezoid?
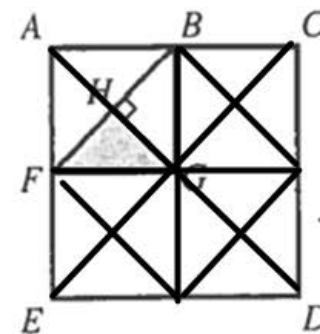

A. 20
B. 36
C. 38
D. 42
E. 70

$$A = \frac{1}{2}(10+18) \cdot 3 = 42$$

NEW – April 2018, #55

In the diagram below, B, F, and H are on $\overline{AC}$, $\overline{AE}$, and $\overline{BF}$, respectively, and $\overline{GH} \perp \overline{BF}$. The area of square $ABGF$ is $\frac{1}{4}$ the area of square $ACDE$. What percent of the area of $ACDE$ does the shaded portion represent?

A. 0.0625%
B. 0.125%
C. 0.25%
D. 6.25%
E. 12.5%

$$\frac{1}{16} = 0.0625 = 6.25\%$$

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Composition of Functions

OLD – June 2013, #28

Given functions $f(x) = x - 5$ and $g(x) = 5 - x^2$, what is $f(g(-4))$?

F. -76
G. -20
H. -16
J. 16
K. 86

NEW – April 2018, #42

Given the functions $f(x) = x^2$ and $g(x) = \frac{1}{4-x}$, what is $g(f(x))$?
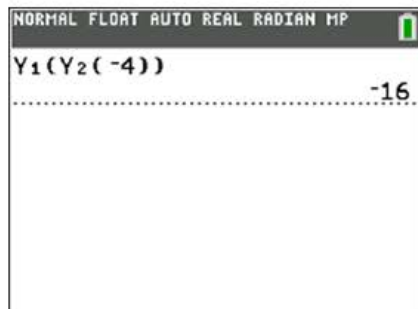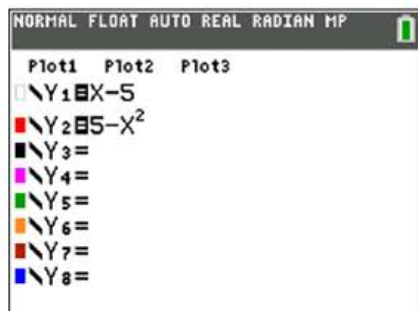
F. $\dfrac{1}{4-x^2}$

G. $\dfrac{1}{(4-x)^2}$

H. $\dfrac{1}{16-x^2}$

J. $\dfrac{x^2}{4-x}$

K. $\dfrac{x^2}{4-x^2}$

Composition of Functions

OLD – June 2013, #28

Given functions $f(x) = x - 5$ and $g(x) = 5 - x^2$, what is $f(g(-4))$?

F. -76
G. -20
H. -16
J. 16
K. 86

```
NORMAL FLOAT AUTO REAL RADIAN MP
Plot1  Plot2  Plot3
 \Y1 ■X-5
■\Y2 ■5-X²
■\Y3=
■\Y4=
■\Y5=
■\Y6=
■\Y7=
■\Y8=
```

```
NORMAL FLOAT AUTO REAL RADIAN MP
Y1(Y2(-4))
                                    -16
```

NEW – April 2018, #42

Given the functions $f(x) = x^2$ and $g(x) = \dfrac{1}{4-x}$, what is $g(f(x))$?

F. $\dfrac{1}{4-x^2}$

G. $\dfrac{1}{(4-x)^2}$

H. $\dfrac{1}{16-x^2}$

J. $\dfrac{x^2}{4-x}$

K. $\dfrac{x^2}{4-x^2}$

$$g(f(x)) = \dfrac{1}{4-\left(x^2\right)}$$