College Admission
Math-for-Liberal-Arts
DSST Math for Liberal Arts Exam (Dantes Subject Standardized Tests)

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Question: 1

Find $[g \circ f]x$ when $f(x) = 2x + 4$ and $g(x) = x^2 - 3x + 2$.

A. $4x^2 + 10x + 6$
B. $2x^2 - 6x + 8$
C. $4x^2 + 13x + 18$
D. $2x^2 - 3x + 6$

Answer: A

Explanation:
Substitute and simplify:
$$[g \circ f]x = g(f(x))$$
$$= g(2x + 4)$$
$$= (2x + 4)^2 - 3(2x + 4) + 2$$
$$= 4x^2 + 16x + 16 - 6x - 12 + 2$$
$$= 4x^2 + 10x + 6$$

Question: 2

If f(x) and g(x) are inverse functions, which of these is the value of x when f (g(x)) = 4?

A. -4
B. $\frac{1}{4}$
C. 2
D. 4

Answer: D

Explanation:
By definition, when $f(x)$ and $g(x)$ are inverse functions, $f(g(x)) = g(f(x)) = x$. So, $f(g(4)) = 4$.

Question: 3

Determine which pair of equations are NOT inverses.

A. $y = x + 6; y = x - 6$
B. $y = 2x + 3; y = 2x - 3$

C. $y = \frac{2x+3}{x-1}; y = \frac{x+3}{x-2}$

D. $y = \frac{x-1}{2}; y = 2x + 1$

Explanation:
To find the inverse of an equation, solve for x in terms of y; then, exchange the variables x and y. Or, to determine if two functions f (x) and g (x) are inverses, find f (g (x)) and g (f (x)); if both results are x, then f (x) and g (x) are inverse functions.

For example, to find the inverse of $y = x + 6$, rewrite the equation $x = y + 6$ and solve for y. Since $y = x - 6$, the two given equations given in Choice A are inverses. Likewise, to find the inverse of $y = \frac{2x+3}{x-1}$, rewrite the equation as $x = \frac{2y+3}{y-1}$ and solve for y:

$$xy - x = 2y + 3$$
$$xy - 2y = x + 3$$
$$y(x - 2) = x + 3$$
$$y = \frac{x+3}{x-2}$$

The two equations given in Choice C are inverses.
Choice B: y = 2(2x + 3) — 3 = 4x + 6. The given equations are NOT inverses.

Choice D: $y = \frac{(2x+1)-1}{2} = \frac{2x}{2} = x$ and $y = 2\left(\frac{x-1}{2}\right) + 1 = x - 1 + 1 = x$, so the two given equations are inverses.

Question: 4

Which of these statements is (are) true for function g(x)?

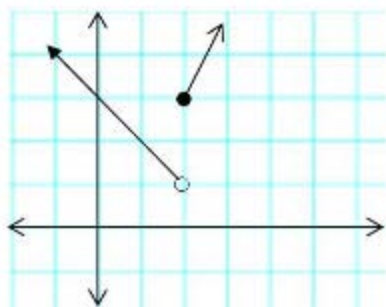$g(x) = \begin{cases} 2x - 1 & x \geq 2 \\ -x + 3 & x < 2 \end{cases}$

I. g (3) = 0
II. The graph of g(x) is discontinuous at x = 2.
III. The range of g(x) is all real numbers.
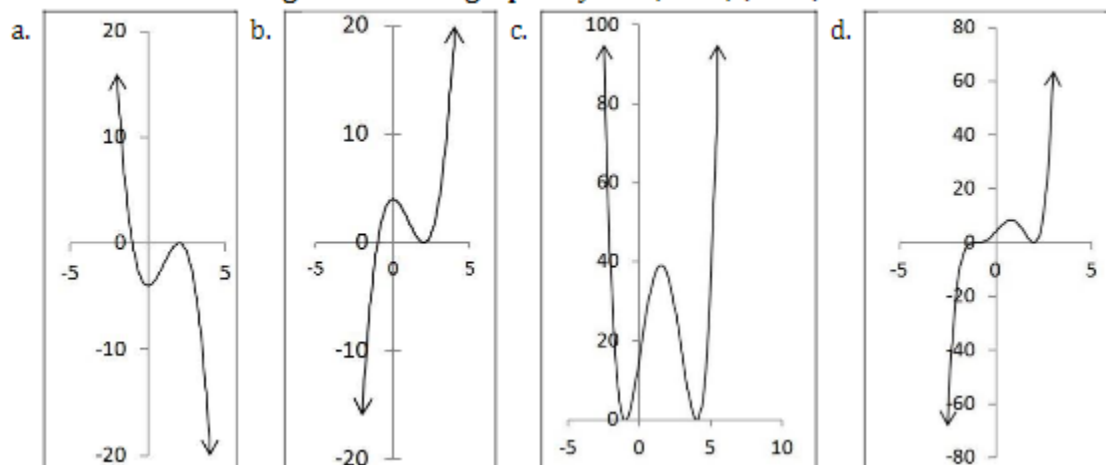
A. II
B. III
C. I, II
D. II, III

Explanation:
Below is the graph of g(x).

Statement II is true: the graph is indeed discontinuous at x = 2. Since g(3) = 2(3) — 1 = 5, Statement I is false, and since the range is y > 1, Statement III is also false.

Question: 5

Which of the following could be the graph of $y = a(x + b)(x + c)^2$ if $a > 0$?

a.

b.

c.

d.

A. Option A
B. Option B
C. Option C
D. Option D

Answer: B

Explanation:

If $y = a(x + b)(x + c)^2$, the degree of the polynomial is 3. Since the degree of the polynomial is odd and the leading coefficient is positive ($a > 0$), the end behavior of the graph goes to (∞, ∞) and $(-\infty, -\infty)$. Therefore, neither Choice A nor Choice C can be a graph of $y = a(x + b)(x + c)^2$. The maximum number of critical points in the graph is at most one less than the degree of the polynomial, so Choice D, cannot be the graph of the function. Choice B displays the correct end behavior and has two bumps, so it is a possible graph of $y = a(x + b)(x + c)^2$.

Question: 6

A school is selling tickets to its production of Annie Get Your Gun. Student tickets cost $3 each, and non-student tickets are $5 each. In order to offset the costs of the production, the school must earn at least $300 in ticket sales. Which graph shows the number of tickets the school must sell to offset production costs?

a.

b.

c.

d.
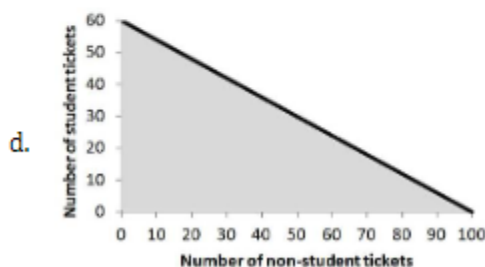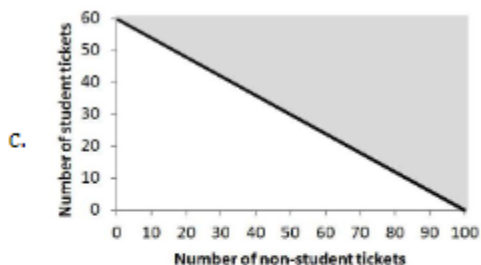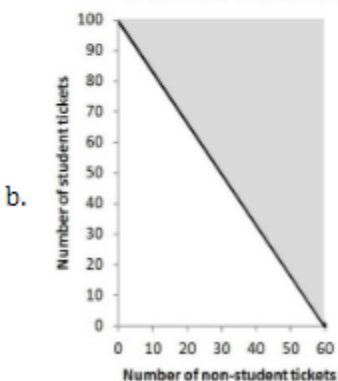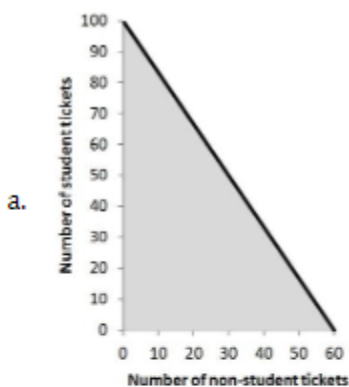
A. Option A
B. Option B
C. Option C
D. Option D

Answer: B

Explanation:
$5n + 3s \geq 300$ where n is the number of non-student tickets which must be sold and s is the number of student tickets which must be sold. The intercepts of this linear inequality are n = 60 and s = 100. The solid line through the two intercepts represents the minimum number of each type of ticket which must be sold in order to offset production costs. All points above the line represent sales which result in a profit for the school.

Question: 7

Which of these is the equation graphed below?
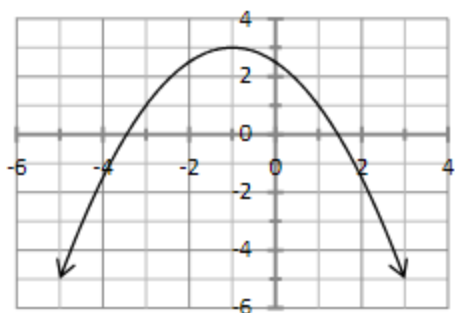
A. $y = -2x^2 - 4x + 1$

B. $y = -x^2 - 2x + 5$

C. $y = -x^2 - 2x + 2$

D. $y = -\frac{1}{2}x^2 - x + \frac{5}{2}$

Answer: D

Explanation:

The vertex form of a quadratic equation is $y = a(x - h)^2 + k$, where $x = h$ is the parabola's axis of symmetry and (h, k) is the parabola's vertex. The vertex of the graph is (-1,3), so the equation can be written as $y = a(x + 1)^2 + 3$. The parabola passes through point (1,1), so $1 = a(1 + 1)^2 + 3$. Solve for a:

$$1 = a(1 + 1)^2 + 3$$
$$1 = a(2)^2 + 3$$
$$1 = 4a + 3$$
$$-2 = 4a$$
$$-\frac{1}{2} = a$$

So, the vertex form of the parabola is $y = -\frac{1}{2}(x + 1)^2 + 3$. Write the equation in the form $y = ax^2 + bx + c$.

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

Question: 8

Solve the system of equations: $\begin{matrix} 3x + 4y = 2 \\ 2x + 6y = -2 \end{matrix}$

A. $\left(0, \frac{1}{2}\right)$

B. $\left(\frac{2}{5}, \frac{1}{5}\right)$

C. $(2, -1)$

D. $\left(-1, \frac{5}{4}\right)$

Explanation:

In order to eliminate x by linear combination, multiply the top equation by 2 and the bottom equation by —3 so that the coefficients of the x-terms will be additive inverses.

$$2(3x + 4y) = (2)2 \qquad\qquad -3(2x + 6y) = (-2)(-3)$$
$$6x + 8y = 4 \qquad\qquad\qquad -6x - 18y = 6$$

Then, add the equations and solve for y.

$$6x + 8y = 4$$
$$+ \; -6x - 18y = 6$$
$$\overline{\qquad -10y = 10}$$
$$y = -1$$

Substitute —1 for y in either of the given equations and solve for x.

$$3x + 4(-1) = 2$$
$$3x - 4 = 2$$
$$3x = 6$$
$$x = 2$$

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