Question ID 584e6e70

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: 584e6e70

One of the factors of $2x^3 + 42x^2 + 208x$ is $x + b$, where b is a positive constant. What is the smallest possible value of b?

ID: 584e6e70 Answer

Correct Answer: 8

Rationale

The correct answer is 8. Since each term of the given expression, $2x^3 + 42x^2 + 208x$, has a factor of $2x$, the expression can be rewritten as $2x(x^2) + 2x(21x) + 2x(104)$, or $2x(x^2 + 21x + 104)$. Since the values 8 and 13 have a sum of 21 and a product of 104, the expression $x^2 + 21x + 104$ can be factored as $(x + 8)(x + 13)$. Therefore, the given expression can be factored as $2x(x + 8)(x + 13)$. It follows that the factors of the given expression are 2, x, $x + 8$, and $x + 13$. Of these factors, only $x + 8$ and $x + 13$ are of the form $x + b$, where b is a positive constant. Therefore, the possible values of b are 8 and 13. Thus, the smallest possible value of b is 8.

Question Difficulty: Hard

Question ID cd96ea0e

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: cd96ea0e

Which expression is equivalent to $(7x^3 + 7x) - (6x^3 - 3x)$?

A. $x^3 + 10x$

B. $-13x^3 + 10x$

C. $-13x^3 + 4x$

D. $x^3 + 4x$

ID: cd96ea0e Answer

Correct Answer: A

Rationale

Choice A is correct. Applying the distributive property, the given expression can be written as $7x^3 + 7x - 6x^3 + 3x$. Grouping like terms in this expression yields $(7x^3 - 6x^3) + (7x + 3x)$. Combining like terms in this expression yields $x^3 + 10x$.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty: Hard

Question ID 0096685d

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: 0096685d

The expression $4x^2 + bx - 45$, where b is a constant, can be rewritten as $(hx + k)(x + j)$, where h, k, and j are integer constants. Which of the following must be an integer?

A. $\frac{b}{h}$

B. $\frac{b}{k}$

C. $\frac{45}{h}$

D. $\frac{45}{k}$

ID: 0096685d Answer

Correct Answer: D

Rationale

Choice D is correct. It's given that $4x^2 + bx - 45$ can be rewritten as $(hx + k)(x + j)$. The expression $(hx + k)(x + j)$ can be rewritten as $hx^2 + jhx + kx + kj$, or $hx^2 + (jh + k)x + kj$. Therefore, $hx^2 + (jh + k)x + kj$ is equivalent to $4x^2 + bx - 45$. It follows that $kj = -45$. Dividing each side of this equation by k yields $j = \frac{-45}{k}$. Since j is an integer, $-\frac{45}{k}$ must be an integer. Therefore, $\frac{45}{k}$ must also be an integer.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty: Hard

Question ID 6b8e2f7a

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: 6b8e2f7a

Which of the following expressions is(are) a factor of $3x^2 + 20x - 63$?

I. $x - 9$

II. $3x - 7$

A. I only

B. II only

C. I and II

D. Neither I nor II

ID: 6b8e2f7a Answer

Correct Answer: B

Rationale

Choice B is correct. The given expression can be factored by first finding two values whose sum is 20 and whose product is $3(-63)$, or -189. Those two values are 27 and -7. It follows that the given expression can be rewritten as $3x^2 + 27x - 7x - 63$. Since the first two terms of this expression have a common factor of $3x$ and the last two terms of this expression have a common factor of -7, this expression can be rewritten as $3x(x + 9) - 7(x + 9)$. Since the two terms of this expression have a common factor of $(x + 9)$, it can be rewritten as $(3x - 7)(x + 9)$. Therefore, expression II, $3x - 7$, is a factor of $3x^2 + 20x - 63$, but expression I, $x - 9$, is not a factor of $3x^2 + 20x - 63$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty: Hard

Question ID ca2d5b7b

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: ca2d5b7b

If $4^{8c} = \sqrt[3]{4^7}$, what is the value of c?

ID: ca2d5b7b Answer

Correct Answer: .2916, .2917, 7/24

Rationale

The correct answer is $\frac{7}{24}$. An expression of the form $\sqrt[n]{a^m}$, where m and n are integers greater than 1 and $a \geq 0$, is equivalent to $a^{\frac{m}{n}}$. Therefore, the expression on the right-hand side of the given equation, $\sqrt[3]{4^7}$, is equivalent to $4^{\frac{7}{3}}$. Thus, $4^{8c} = 4^{\frac{7}{3}}$. It follows that $8c = \frac{7}{3}$. Dividing both sides of this equation by 8 yields $c = \frac{7}{24}$. Note that 7/24, .2916, .2917, 0.219, and 0.292 are examples of ways to enter a correct answer.

Question Difficulty: Hard

Question ID 432bfc95

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: 432bfc95

Which expression is equivalent to $\frac{h^{15}q^7}{h^5q^{21}}$, where $h > 0$ and $q > 0$?

A. $\frac{h^{10}}{q^{14}}$

B. $\frac{h^3}{q^3}$

C. $h^{10}q^{14}$

D. h^3q^3

ID: 432bfc95 Answer

Correct Answer: A

Rationale

Choice A is correct. For positive values of a, $\frac{a^m}{a^n} = a^{(m-n)}$, where m and n are integers. Since it's given that $h > 0$ and $q > 0$, this property can be applied to rewrite the given expression as $\left(h^{(15-5)}\right)\left(q^{(7-21)}\right)$, which is equivalent to $h^{10}q^{-14}$. For positive values of a, $a^{-n} = \frac{1}{a^n}$. This property can be applied to rewrite the expression $h^{10}q^{-14}$ as $\left(h^{10}\right)\left(\frac{1}{q^{14}}\right)$, which is equivalent to $\frac{h^{10}}{q^{14}}$.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty: Hard

Question ID 5c88849a

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: 5c88849a

$$g(x) = \frac{3}{5}x + \frac{7}{6}$$
$$h(x) = 6x - 5$$

The functions g and h are defined by the equations shown. Which expression is equivalent to $g(x) \cdot h(x)$?

A. $\frac{18x^2}{5} - \frac{35}{6}$

B. $\frac{18x^2}{5} + \frac{27x}{11} - \frac{35}{6}$

C. $\frac{18x^2}{5} - 4x - \frac{35}{6}$

D. $\frac{18x^2}{5} + 4x - \frac{35}{6}$

ID: 5c88849a Answer

Correct Answer: D

Rationale

Choice D is correct. It's given that $g(x) = \frac{3}{5}x + \frac{7}{6}$ and $h(x) = 6x - 5$. Substituting $\frac{3}{5}x + \frac{7}{6}$ for $g(x)$ and $6x - 5$ for $h(x)$ in the expression $g(x) \cdot h(x)$ yields $\left(\frac{3}{5}x + \frac{7}{6}\right)(6x - 5)$. This expression can be rewritten as $\frac{3}{5}x(6x - 5) + \frac{7}{6}(6x - 5)$, or $\frac{18x^2}{5} - 3x + 7x - \frac{35}{6}$, which is equivalent to $\frac{18x^2}{5} + 4x - \frac{35}{6}$.

Choice A is incorrect. This expression is equivalent to $\frac{3}{5}x(6x) + \frac{7}{6}(-5)$, not $\left(\frac{3}{5}x + \frac{7}{6}\right)(6x - 5)$.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect. This expression is equivalent to $\left(\frac{3}{5}x - \frac{7}{6}\right)(6x + 5)$, not $\left(\frac{3}{5}x + \frac{7}{6}\right)(6x - 5)$.

Question Difficulty: Hard

Question ID 1bfc4f51

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: 1bfc4f51

Which expression is equivalent to $6x^8y^2 + 12x^2y^2$?

A. $6x^2y^2(2x^6)$

B. $6x^2y^2(x^4)$

C. $6x^2y^2(x^6 + 2)$

D. $6x^2y^2(x^4 + 2)$

ID: 1bfc4f51 Answer

Correct Answer: C

Rationale

Choice C is correct. Since each term of the given expression has a common factor of $6x^2y^2$, it may be rewritten as $6x^2y^2(x^6) + 6x^2y^2(2)$, or $6x^2y^2(x^6 + 2)$.

Choice A is incorrect. This expression is equivalent to $12x^8y^2$, not $6x^8y^2 + 12x^2y^2$.

Choice B is incorrect. This expression is equivalent to $6x^6y^2$, not $6x^8y^2 + 12x^2y^2$.

Choice D is incorrect. This expression is equivalent to $6x^6y^2 + 12x^2y^2$, not $6x^8y^2 + 12x^2y^2$.

Question Difficulty: Hard

Question ID d31ac27a

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: d31ac27a

$$0.36x^2 + 0.63x + 1.17$$

The given expression can be rewritten as $a(4x^2 + 7x + 13)$, where a is a constant. What is the value of a?

ID: d31ac27a Answer

Correct Answer: .09, 9/100

Rationale

The correct answer is $.09$. It's given that the expression $0.36x^2 + 0.63x + 1.17$ can be rewritten as $a(4x^2 + 7x + 13)$. Applying the distributive property to the expression $a(4x^2 + 7x + 13)$ yields $4ax^2 + 7ax + 13a$. Therefore, $0.36x^2 + 0.63x + 1.17$ can be rewritten as $4ax^2 + 7ax + 13a$. It follows that in the expressions $0.36x^2 + 0.63x + 1.17$ and $4ax^2 + 7ax + 13a$, the coefficients of x^2 are equivalent, the coefficients of x are equivalent, and the constant terms are equivalent. Therefore, $0.36 = 4a$, $0.63 = 7a$, and $1.17 = 13a$. Solving any of these equations for a yields the value of a. Dividing both sides of the equation $0.36 = 4a$ by 4 yields $0.09 = a$. Therefore, the value of a is 0.09. Note that .09 and 9/100 are examples of ways to enter a correct answer.

Question Difficulty: Hard

Question ID 75a3b0d6

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: 75a3b0d6

Which expression is equivalent to $(x^2 + 11)^2 + (x - 5)(x + 5)$?

A. $x^4 + 23x^2 - 14$

B. $x^4 + 23x^2 + 96$

C. $x^4 + 12x^2 + 121$

D. $x^4 + x^2 + 146$

ID: 75a3b0d6 Answer

Correct Answer: B

Rationale

Choice B is correct. The expression $(x^2 + 11)^2$ can be written as $(x^2 + 11)(x^2 + 11)$, which is equivalent to $x^2(x^2 + 11) + 11(x^2 + 11)$. Distributing x^2 and 11 to $(x^2 + 11)$ yields $x^4 + 11x^2 + 11x^2 + 121$, or $x^4 + 22x^2 + 121$. The expression $(x - 5)(x + 5)$ is equivalent to $(x - 5)x + (x - 5)5$. Distributing x and 5 to $(x - 5)$ yields $x^2 - 5x + 5x - 25$, or $x^2 - 25$. Therefore, the expression $(x^2 + 11)^2 + (x - 5)(x + 5)$ is equivalent to $(x^4 + 22x^2 + 121) + (x^2 - 25)$, or $x^4 + 22x^2 + 121 + x^2 - 25$. Combining like terms in this expression yields $x^4 + 23x^2 + 96$.

Choice A is incorrect. Equivalent expressions must be equivalent for any value of x. Substituting 0 for x in this expression yields -14, whereas substituting 0 for x in the given expression yields 96.

Choice C is incorrect. Equivalent expressions must be equivalent for any value of x. Substituting 0 for x in this expression yields 121, whereas substituting 0 for x in the given expression yields 96.

Choice D is incorrect. Equivalent expressions must be equivalent for any value of x. Substituting 0 for x in this expression yields 146, whereas substituting 0 for x in the given expression yields 96.

Question Difficulty: Hard

Question ID a36c8654

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: a36c8654

Which expression represents the product of $\left(x^{-6}y^3z^5\right)$ and $\left(x^4z^5+y^8z^{-7}\right)$?

A. $x^{-2}z^{10}+y^{11}z^{-2}$

B. $x^{-2}z^{10}+x^{-6}z^{-2}$

C. $x^{-2}y^3z^{10}+y^8z^{-7}$

D. $x^{-2}y^3z^{10}+x^{-6}y^{11}z^{-2}$

ID: a36c8654 Answer

Correct Answer: D

Rationale

Choice D is correct. The product of $\left(x^{-6}y^3z^5\right)$ and $\left(x^4z^5+y^8z^{-7}\right)$ can be represented by the expression $\left(x^{-6}y^3z^5\right)\left(x^4z^5+y^8z^{-7}\right)$. Applying the distributive property to this expression yields $\left(x^{-6}y^3z^5\right)\left(x^4z^5\right)+\left(x^{-6}y^3z^5\right)\left(y^8z^{-7}\right)$, or $x^{-6}x^4y^3z^5z^5+x^{-6}y^3y^8z^5z^{-7}$. This expression is equivalent to $x^{-6+4}y^3z^{5+5}+x^{-6}y^{3+8}z^{5-7}$, or $x^{-2}y^3z^{10}+x^{-6}y^{11}z^{-2}$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty: Hard

Question ID 716b77c8

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: 716b77c8

The expression $(3x - 23)(19x + 6)$ is equivalent to the expression $ax^2 + bx + c$, where a, b, and c are constants. What is the value of b?

ID: 716b77c8 Answer

Correct Answer: -419

Rationale

The correct answer is -419. It's given that the expression $(3x - 23)(19x + 6)$ is equivalent to the expression $ax^2 + bx + c$, where a, b, and c are constants. Applying the distributive property to the given expression, $(3x - 23)(19x + 6)$, yields $(3x)(19x) + (3x)(6) - (23)(19x) - (23)(6)$, which can be rewritten as $57x^2 + 18x - 437x - 138$. Combining like terms yields $57x^2 - 419x - 138$. Since this expression is equivalent to $ax^2 + bx + c$, it follows that the value of b is -419.

Question Difficulty: Hard

Question ID c5d23b51

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: c5d23b51

Which expression is equivalent to $(8x^3 + 8) - (x^3 - 2)$?

A. $8x^3 + 6$

B. $7x^3 + 10$

C. $8x^3 + 10$

D. $7x^3 + 6$

ID: c5d23b51 Answer

Correct Answer: B

Rationale

Choice B is correct. The given expression is equivalent to $8x^3 + 8 - x^3 - (-2)$, or $8x^3 + 8 - x^3 + 2$. Combining like terms in this expression yields $7x^3 + 10$.

Choice A is incorrect. This expression is equivalent to $(8x^3 + 8) - 2$, not $(8x^3 + 8) - (x^3 - 2)$.

Choice C is incorrect. This expression is equivalent to $(8x^3 + 8) - (-2)$, not $(8x^3 + 8) - (x^3 - 2)$.

Choice D is incorrect. This expression is equivalent to $(8x^3 + 8) - (x^3 + 2)$, not $(8x^3 + 8) - (x^3 - 2)$.

Question Difficulty: Hard

Question ID aefd363a

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: aefd363a

$$f(x) = x^2 + bx$$
$$g(x) = 9x^2 - 27x$$

Functions f and g are given, and in function f, b is a constant. If $f(x) \cdot g(x) = 9x^4 - 26x^3 - 3x^2$, what is the value of b?

A. -26

B. $-\frac{26}{9}$

C. $\frac{1}{9}$

D. 9

ID: aefd363a Answer

Correct Answer: C

Rationale

Choice C is correct. Multiplying the given functions f and g yields $f(x) \cdot g(x) = (x^2 + bx)(9x^2 - 27x)$. Applying the distributive property to the right-hand side of this equation yields $f(x) \cdot g(x) = (x^2)(9x^2 - 27x) + (bx)(9x^2 - 27x)$. Applying the distributive property once again to the right-hand side of this equation yields $f(x) \cdot g(x) = (x^2)(9x^2) - (x^2)(27x) + (bx)(9x^2) - (bx)(27x)$, which is equivalent to $f(x) \cdot g(x) = 9x^4 - 27x^3 + 9bx^3 - 27bx^2$. Factoring out x^3 from the second and third terms yields $f(x) \cdot g(x) = 9x^4 + (-27 + 9b)x^3 - 27bx^2$. Since the left-hand sides of $f(x) \cdot g(x) = 9x^4 + (-27 + 9b)x^3 - 27bx^2$ and $f(x) \cdot g(x) = 9x^4 - 26x^3 - 3x^2$ are equal, it follows that $(-27 + 9b)x^3 = -26x^3$, or $-27 + 9b = -26$, and $-27bx^2 = -3x^2$, or $-27b = -3$. Adding 27 to each side of $-27 + 9b = -26$ yields $9b = 1$. Dividing each side of this equation by 9 yields $b = \frac{1}{9}$. Similarly, dividing each side of $-27b = -3$ by -27 yields $b = \frac{1}{9}$. Therefore, the value of b is $\frac{1}{9}$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty: Hard

Question ID 51a58219

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: 51a58219

Which expression is equivalent to $(d-6)(8d^2-3)$?

A. $8d^3-14d^2-3d+18$

B. $8d^3-17d^2+48$

C. $8d^3-48d^2-3d+18$

D. $8d^3-51d^2+48$

ID: 51a58219 Answer

Correct Answer: C

Rationale

Choice C is correct. Applying the distributive property to the given expression yields $d(8d^2-3)-6(8d^2-3)$. Applying the distributive property once again to this expression yields $(d)(8d^2)+(d)(-3)+(-6)(8d^2)+(-6)(-3)$, or $8d^3+(-3d)+(-48d^2)+18$. This expression can be rewritten as $8d^3-48d^2-3d+18$. Thus, $(d-6)(8d^2-3)$ is equivalent to $8d^3-48d^2-3d+18$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty: Hard

Question ID af181cc6

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: af181cc6

The expression $90y^5 - 54y^4$ is equivalent to $ry^4(15y - 9)$, where r is a constant. What is the value of r?

ID: af181cc6 Answer

Correct Answer: 6

Rationale

The correct answer is 6. Applying the distributive property to the expression $ry^4(15y - 9)$ yields $15ry^5 - 9ry^4$. Since $90y^5 - 54y^4$ is equivalent to $ry^4(15y - 9)$, it follows that $90y^5 - 54y^4$ is also equivalent to $15ry^5 - 9ry^4$. Since these expressions are equivalent, it follows that corresponding coefficients are equivalent. Therefore, $90 = 15r$ and $-54 = -9r$. Solving either of these equations for r will yield the value of r. Dividing both sides of $90 = 15r$ by 15 yields $6 = r$. Therefore, the value of r is 6.

Question Difficulty: Hard

Question ID e4cf986e

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: e4cf986e

Which expression is equivalent to $\frac{42a}{k} + 42ak$, where $k > 0$?

A. $\frac{84a}{k}$

B. $\frac{84ak^2}{k}$

C. $\frac{42a(k+1)}{k}$

D. $\frac{42a(k^2+1)}{k}$

ID: e4cf986e Answer

Correct Answer: D

Rationale

Choice D is correct. Two fractions can be added together when they have a common denominator. Since $k > 0$, multiplying the second term in the given expression by $\frac{k}{k}$ yields $\frac{(42ak)k}{k}$, which is equivalent to $\frac{42ak^2}{k}$. Therefore, the expression $\frac{42a}{k} + 42ak$ can be written as $\frac{42a}{k} + \frac{42ak^2}{k}$ which is equivalent to $\frac{42a+42ak^2}{k}$. Since each term in the numerator of this expression has a factor of $42a$, the expression $\frac{42a+42ak^2}{k}$ can be rewritten as $\frac{42a(1)+42a(k^2)}{k}$, or $\frac{42a(1+k^2)}{k}$, which is equivalent to $\frac{42a(k^2+1)}{k}$.

Choice A is incorrect. This expression is equivalent to $\frac{42a}{k} + \frac{42a}{k}$.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect. This expression is equivalent to $\frac{42a}{k} + 42a$.

Question Difficulty: Hard

Question ID 01256117

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: 01256117

Which of the following expressions has a factor of $x + 2b$, where b is a positive integer constant?

A. $3x^2 + 7x + 14b$

B. $3x^2 + 28x + 14b$

C. $3x^2 + 42x + 14b$

D. $3x^2 + 49x + 14b$

ID: 01256117 Answer

Correct Answer: D

Rationale

Choice D is correct. Since each choice has a term of $3x^2$, which can be written as $(3x)(x)$, and each choice has a term of $14b$, which can be written as $(7)(2b)$, the expression that has a factor of $x + 2b$, where b is a positive integer constant, can be represented as $(3x + 7)(x + 2b)$. Using the distributive property of multiplication, this expression is equivalent to $3x(x + 2b) + 7(x + 2b)$, or $3x^2 + 6xb + 7x + 14b$. Combining the *x*-terms in this expression yields $3x^2 + (7 + 6b)x + 14b$. It follows that the coefficient of the *x*-term is equal to $7 + 6b$. Thus, from the given choices, $7 + 6b$ must be equal to 7, 28, 42, or 49. Therefore, $6b$ must be equal to 0, 21, 35, or 42, respectively, and b must be equal to $\frac{0}{6}$, $\frac{21}{6}$, $\frac{35}{6}$, or $\frac{42}{6}$, respectively. Of these four values of b, only $\frac{42}{6}$, or 7, is a positive integer. It follows that $7 + 6b$ must be equal to 49 because this is the only choice for which the value of b is a positive integer constant. Therefore, the expression that has a factor of $x + 2b$ is $3x^2 + 49x + 14b$.

Choice A is incorrect. If this expression has a factor of $x + 2b$, then the value of b is 0, which isn't positive.

Choice B is incorrect. If this expression has a factor of $x + 2b$, then the value of b is $\frac{21}{6}$, which isn't an integer.

Choice C is incorrect. If this expression has a factor of $x + 2b$, then the value of b is $\frac{35}{6}$, which isn't an integer.

Question Difficulty: Hard

Question ID 477e2240

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: 477e2240

Which of the following expressions is equivalent to $8x^{10} - 8x^9 + 88x$?

A. $x(7x^{10} - 7x^9 + 87x)$

B. $x(8^{10} - 8^9 + 88)$

C. $8x(x^{10} - x^9 + 11x)$

D. $8x(x^9 - x^8 + 11)$

ID: 477e2240 Answer

Correct Answer: D

Rationale

Choice D is correct. Since $8x$ is a common factor of each term in the given expression, the expression can be rewritten as $8x(x^9 - x^8 + 11)$.

Choice A is incorrect. This expression is equivalent to $7x^{11} - 7x^{10} + 87x^2$.

Choice B is incorrect. This expression is equivalent to $8^{10}x - 8^9x + 88x$.

Choice C is incorrect. This expression is equivalent to $8x^{11} - 8x^{10} + 88x^2$.

Question Difficulty: Hard

Question ID 4928d11a

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: 4928d11a

If $k - x$ is a factor of the expression $-x^2 + \frac{1}{29}nk^2$, where n and k are constants and $k > 0$, what is the value of n?

A. -29

B. $-\frac{1}{29}$

C. $\frac{1}{29}$

D. 29

ID: 4928d11a Answer

Correct Answer: D

Rationale

Choice D is correct. If $k - x$ is a factor of the expression $-x^2 + \left(\frac{1}{29}\right)nk^2$, then the expression can be written as $(k - x)(ax + b)$, where a and b are constants. This expression can be rewritten as $akx + bk - ax^2 - bx$, or $-ax^2 + (ak - b)x + bk$. Since this expression is equivalent to $-x^2 + \left(\frac{1}{29}\right)nk^2$, it follows that $-a = -1$, $ak - b = 0$, and $bk = \left(\frac{1}{29}\right)nk^2$. Dividing each side of the equation $-a = -1$ by -1 yields $a = 1$. Substituting 1 for a in the equation $ak - b = 0$ yields $k - b = 0$. Adding b to each side of this equation yields $k = b$. Substituting k for b in the equation $bk = \left(\frac{1}{29}\right)nk^2$ yields $k^2 = \left(\frac{1}{29}\right)nk^2$. Since k is positive, dividing each side of this equation by k^2 yields $1 = \left(\frac{1}{29}\right)n$. Multiplying each side of this equation by 29 yields $29 = n$.

Alternate approach: The expression $x^2 - y^2$ can be written as $(x - y)(x + y)$, which is a difference of two squares. It follows that $\left(\frac{1}{29}\right)nk^2 - x^2$ is equivalent to $\left(\left(\sqrt{\frac{1}{29}n}\right)k - x\right)\left(\left(\sqrt{\frac{1}{29}n}\right)k + x\right)$. It's given that $k - x$ is a factor of $-x^2 + \left(\frac{1}{29}\right)nk^2$, so the factor $\left(\sqrt{\frac{1}{29}n}\right)k - x$ is equal to $k - x$. Adding x to both sides of the equation $\left(\sqrt{\frac{1}{29}n}\right)k - x = k - x$ yields $\left(\sqrt{\frac{1}{29}n}\right)k = k$. Since k is positive, dividing both sides of this equation by k yields $\sqrt{\frac{1}{29}n} = 1$. Squaring both sides of this equation yields $\frac{1}{29}n = 1$. Multiplying both sides of this equation by 29 yields $n = 29$.

Choice A is incorrect. This value of n gives the expression $-x^2 + \left(\frac{1}{29}\right)(-29)k^2$, or $-x^2 - k^2$. This expression doesn't have $k - x$ as a factor.

Choice B is incorrect. This value of n gives the expression $-x^2 + \left(\frac{1}{29}\right)\left(-\frac{1}{29}\right)k^2$, or $-x^2 + \left(-\frac{1}{841}\right)k^2$. This expression doesn't have $k - x$ as a factor.

Choice C is incorrect. This value of n gives the expression $-x^2 + \left(\frac{1}{29}\right)\left(\frac{1}{29}\right)k^2$, or $-x^2 + \left(\frac{1}{841}\right)k^2$. This expression doesn't have $k - x$ as a factor.

Question Difficulty: Hard

Question ID 22da0031

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Advanced Math	Equivalent expressions	Hard

ID: 22da0031

$$(5x^3 - 3) - (-4x^3 + 8)$$

The given expression is equivalent to $bx^3 - 11$, where b is a constant. What is the value of b?

ID: 22da0031 Answer

Correct Answer: 9

Rationale

The correct answer is 9. The given expression can be rewritten as $(5x^3 - 3) + (-1)(-4x^3 + 8)$. By applying the distributive property, this expression can be rewritten as $5x^3 - 3 + 4x^3 + (-8)$, which is equivalent to $(5x^3 + 4x^3) + (-3 + (-8))$. Adding like terms in this expression yields $9x^3 - 11$. Since it's given that $(5x^3 - 3) - (-4x^3 + 8)$ is equivalent to $bx^3 - 11$, it follows that $9x^3 - 11$ is equivalent to $bx^3 - 11$. Therefore, the coefficients of x^3 in these two expressions must be equivalent, and the value of b must be 9.

Question Difficulty: Hard