TT S2 SBE Ch2 Identities and Factorization Q

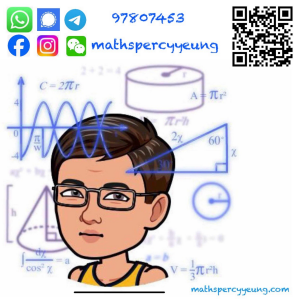
Properties of Identities

An identity is an equation which can be satisfied by all values of the unknown(s).

Property 1 : An identity can be satisfied by all values of the unknown(s).

Property 2: The terms on both sides of the identity after simplification are exactly the same.

Exercise 2A



Show that each of the following equations is an identity. (1 – 10)

1. $5x + 9x = 14x$

2. $-4x(3x) = -12x^2$

3. $8(2x - 1) = 16x - 8$

4. $3(5 - 7x) - 11 = -21x + 4$

5. $4x - 2(6 - 5x) = 2(7x - 6)$

6. $2(8x - 15) - 6 = 4(4x - 9)$

7. $5(5x + 3) - 25 = 32x - (7x + 10)$

8. $7(4 + x) - (3 - 2x) = -2 + 9(x + 3)$

9. $(x + 2y) - (2x + y) = -(x - y)$

10. $3y(1 + x) - 2xy = y(x + 3)$

Show that each of the following equations is not an identity. (11 – 18)

11. $2x + 19x = 27x - 5x$

12. $-11xy = -3x(-8y)$

13. $4(5x + 2) - 3 = 20x - 1$

14. $-(9x - 1) = 2(7x + 1) - 1$

15. $3(12 - 5y) = 5(3y + 6) + 12$

16. $8(2y + 1) - 10y = -2(4 - 3y)$

17. $-2(6x - y) + 5x = 2x - (9x + 2y)$

18. $10 - 5(3x - 7y) = 7(5y + x) + 10$

Determine whether each of the following equations is an identity. (19 – 24)

19. $8(3a + 2) - 11 = 5 + 24a$

20. $3(5 - 2b) = 20b - 1 + 3b$

21. $-20pq - 16q + 8q = -4q(5p + 2q)$

22. $11p(-q + 2) - 3p = 19p - 11pq$

23. $4(2m^2 - 15) - 9m = 8m^2 - 12m + 30$

24. $-7(5n + 2) + 14n^2 = -35n + 2(7n^2 - 7)$

In each of the following identities, A and B are constants. Find the values of A and B. (25 – 34)

25. $6x(x - 2) \equiv Ax^2 + Bx$

26. $4(3A + x) \equiv Bx - 36$

27. $-2x(Ax + 5) \equiv -8x^2 + Bx$

28. $7A(x - 2y) \equiv -21x + By$

29. $3(-3-8x)-Ax \equiv x+B$

30. $5(2x-6)+3(10-x) \equiv Ax+B$

31. $-(Ax-5)-9(x+6) \equiv -15x+B$

32. $8y(6+y)+5-23y \equiv Ay^2+By+5$

33. $(x+7)(4x-1) \equiv Ax^2-Bx-7$

34. $(3y+1)(2y-3) \equiv Ay^2-7y+B$

Show that each of the following equations is an identity. (35 – 40)

35. $(3x+11)(2x-1) \equiv 6x^2+19x-11$

36. $(9-y)(4y-5) \equiv -4y^2+41y-45$

37. $-2a(6a+b)-13ab = -3a(4a+5b)$

38. $3(p^2+8pq)-p(28q-17p) = -4pq+20p^2$

39. $\dfrac{4x+1}{2}-\dfrac{1-3x}{3}=\dfrac{18x+1}{6}$

40. $\dfrac{-2x-5}{3}+\dfrac{4+x}{4}=\dfrac{-5x-8}{12}$

Show that each of the following equations is not an identity. (41 – 46)

41. $(7x-2)(3+x)+9 = 7x^2-9x+3$

42. $x(12x+y)-y(5y-8x) = 12x^2-9xy-5y^2$

43. $16a^2-a(4a+5) = 8a-4(3a^2-a)$

44. $(3a+b)(b-6a)-3b^2 = -9a^2+7ab+2b^2-4ab$

45. $(p-2q)^2 = (p+q)(p-4q)+pq$

46. $\dfrac{7x+2}{6}-\dfrac{x-5}{3}=\dfrac{4x}{3}+3$

Determine whether each of the following equations is an identity. (47 – 52)

47. $(1-9x)(4-2x)+17x = 18x^2-21x+4$

48. $-2x(x+8y)+4y(3x-2y) = 2x^2-4xy-7y^2$

49. $5a(3b+1)-3(7ab+a^2) = -6ab-a(3a-5)$

50. $(4q+p)(5p+3q)-3pq = 5p^2+14pq+3q^2$

51. $\dfrac{5x-8}{3}+\dfrac{2+3x}{9}=2x-\dfrac{22}{9}$

52. $\dfrac{x-3y}{4}-\dfrac{y+2x}{5}=\dfrac{-x}{10}-y$

In each of the following identities, A, B and C are constants. Find the values of A, B and C. (53 – 57)

53. $(7x-6)(x+5) \equiv Ax^2+Bx+C$

54. $(Ax-3)(8-3x) \equiv 6x^2-Bx+C$

55. $13y^2-(Ay+5)(y-2B) \equiv 9y^2+3y-C$

56. $-(4y+5)(2-6y) \equiv Ay^2+By(y+2)+C$

57. $A(x^2-5)+B(4x-3)-6C \equiv 18x^2-12x-45$

58. In the following identity, A, B and C are constants. Find the values of A, B and C.

$A(x-2)(4x+1)+Bx(x-1)+Cx(x+3) \equiv 3x^2+7x+4$

Using Identities to do Expansion

For any values of a and b,

$(a + b)(a - b) \equiv a^2 - b^2$

$(a + b)^2 \equiv a^2 + 2ab + b^2$

$(a - b)^2 \equiv a^2 - 2ab + b^2$

Exercise 2B

Expand each of the following expressions. (1 – 10)

1. **(a)** $(x + 6)(x - 6)$ **(b)** $(3y - 1)(3y + 1)$

2. **(a)** $(2a - 3)(2a + 3)$ **(b)** $(4b + 5)(4b - 5)$

3. **(a)** $(7p + 2)(7p - 2)$ **(b)** $(10 - q)(10 + q)$

4. **(a)** $(5x + y)(5x - y)$ **(b)** $(a - 8b)(a + 8b)$

5. **(a)** $(6s - 11t)(6s + 11t)$ **(b)** $(9u + 4v)(9u - 4v)$

6. **(a)** $(3e + 7f)(3e - 7f)$ **(b)** $(12p - 5q)(12p + 5q)$

7. **(a)** $(8c - 9d)(8c + 9d)$ **(b)** $(2g + 15h)(2g - 15h)$

8. **(a)** $2(5w + 6v)(5w - 6v)$ **(b)** $3(9h - 2k)(9h + 2k)$

9. **(a)** $\frac{1}{4}(4a - 6b)(4a + 6b)$ **(b)** $\left(x - \frac{y}{7}\right)\left(x + \frac{y}{7}\right)$

10. **(a)** $\left(\frac{a}{2} + \frac{b}{3}\right)\left(\frac{a}{2} - \frac{b}{3}\right)$ **(b)** $32\left(\frac{x}{8} - \frac{y}{4}\right)\left(\frac{x}{8} + \frac{y}{4}\right)$

Expand each of the following expressions. (11 – 17)

11. **(a)** $(4x + 3y)(3y - 4x)$ **(b)** $(-9a - b)(-9a + b)$

12. **(a)** $(ab - 8)(ab + 8)$ **(b)** $(2xy + 5)(5 - 2xy)$

13. **(a)** $(a^4 + b^3)(a^4 - b^3)$ **(b)** $(7x^2 - y^5)(7x^2 + y^5)$

14. **(a)** $(a^2b - 2)(a^2b + 2)$ **(b)** $(5 + 3xy^3)(5 - 3xy^3)$

15. **(a)** $(6p^2 + 11q)(-11q + 6p^2)$ **(b)** $(-4s - 5t^2)(-4s + 5t^2)$

16. **(a)** $5(2mn - 3l)(3l + 2mn)$ **(b)** $-2(10a + 7b)(-7b + 10a)$

17. **(a)** $\left(\frac{x}{14} - \frac{5y}{14}\right)\left(\frac{x}{3} + \frac{5y}{3}\right)$ **(b)** $-\left(\frac{a^2}{3} + 6b\right)\left(\frac{a^2}{3} - 6b\right)$

18. **(a)** Expand $(2x + 1)(2x - 1)$.

(b) Hence, expand $(2x + 1)(2x - 1)(4x^2 + 1)$.

Using Identities to do Expansion

For any values of a and b,

$(a + b)(a - b) \equiv a^2 - b^2$

$(a + b)^2 \equiv a^2 + 2ab + b^2$

$(a - b)^2 \equiv a^2 - 2ab + b^2$

Exercise 2C

Expand each of the following expressions. (1 – 18)

1. $(x + 2)^2$

2. $(x - 7)^2$

3. $(2x + 5)^2$

4. $(3x - 1)^2$

5. $(5a + 2)^2$

6. $(4b - 7)^2$

7. $(-2e + 5)^2$

8. $(10 - 3f)^2$

9. $(x + 8y)^2$

10. $(9x - y)^2$

11. $(8p + 11q)^2$

12. $(7t - 2s)^2$

13. $(-3s + 4t)^2$

14. $(-4x + 5y)^2$

15. $(-m - 6n)^2$

16. $(-c - 9d)^2$

17. $2(2c + d)^2$

18. $-5(2x - 3y)^2$

Expand each of the following expressions. (19 – 28)

19. $\left(\frac{x}{3} + 2y\right)^2$

20. $\left(\frac{a}{4} - \frac{b}{5}\right)^2$

21. $(2a^3 + 9)^2$

22. $(11x^3 - 7y^4)^2$

23. $\left(-\frac{2}{s} + \frac{13}{t}\right)^2$, where $s \neq 0$ and $t \neq 0$

24. $36\left(\frac{5x}{3} - \frac{y}{6}\right)^2$

25. $[5(-x + 4y)]^2$

26. $[-3(7x + 2y)]^2$

27. $(6xy + 5z)^2$

28. $(3a - 10bc)^2$

29. **(a)** Expand $(x^2 + 1)^2$.

(b) Expand $(x^2 - 1)^2$.

(c) Hence, expand $(x^4 + 2x^2 + 1)(x^4 - 2x^2 + 1)$.

30. **(a)** Expand $(x + 6)^2$.

(b) Hence, expand $(4x + 24)^2$.

31. **(a)** Expand $(a - 5b)^2$.

(b) Hence, expand $[(x - 7) - 5y]^2$.

32. **(a)** Expand $(x + 2y)^2$.

(b) Hence, expand $\left(a + \frac{2}{a}\right)^2$, where $a \neq 0$.

33. Suppose $a \neq 0$.

(a) Expand $\left(a - \frac{1}{a}\right)^2$.

(b) Expand $\left(a + \frac{1}{a}\right)^2$.

(c) Hence, expand $\left[\left(a + \frac{1}{a}\right)^2 + \left(a - \frac{1}{a}\right)^2\right]\left[\left(a + \frac{1}{a}\right)^2 - \left(a - \frac{1}{a}\right)^2\right]$.

34. **(a)** Expand $(x + y)^2$.

(b) Hence, expand $(a + b + c)^2$.

Factorization by taking out Common Factors

The expression $xy + xz$ can be factorized by taking out the common factor x:

e.g.

$xy + xz = x(y + z)$

Exercise 2D

Factorize each of the following expressions. (1 – 42)

1. $3a + 12b$

2. $15b - 9c$

3. $-26c - 39d$

4. $-3e + 7de$

5. $4pqr + 9pr$

6. $-24ab - 60bc$

7. $-25abc + 30bcd$

8. $x^3 + x^2$

9. $-26p^2 - 13pq$

10. $4p^2q - 6pq^2$

11. $11x^3y + 3xy^2z$

12. $24a^2b^3c - 16b^2c^2$

13. $-4a - 36b - 24c$

14. $6b - 18a + 27c$

15. $2p - 5pq - 7pr$

16. $-15tu + 3u + 21uv$

17. $20m + 15mn - 25mp$

18. $-22rt - 121st + 132rst$

19. $abc + abd - bcd$

20. $3dh + 9cdh - 81dgh$

21. $p^4q + p^3q - p^5$

22. $3x^3y + 2x^2z + 5x^4y$

23. $-9p^2q - 6p^2r - 12pq$

24. $-27x^2yz + 18xy^2z - 45xyz^2$

25. $p(p - q) + (p - q)$

26. $s(s - t) - 3t(s - t)$

27. $q(p - 2q) + (2q - p)$

28. $4m(3m - 5n) - n(5n - 3m)$

29. $2x(3x - 4y) - 21x + 28y$

30. $5b(5b - a) + a(a - 5b)$

31. $4x(3y - 2x) + 6y(2x - 3y)$

32. $(x + 4y)^2 + x + 4y$

33. $(a + 4b)^2 - 3(a + 4b)$

34. $4(p - 5) - (p - 5)^2$

35. $s(7s + 9t) - (7s + 9t)^2$

36. $10b - 2ab - (a - 5)^2$

37. $(2x + y)(6x - 11y) + 4y(6x - 11y)$

38. $(2p - q)(5p - 8q) - 4p(8q - 5p)$

39. $(8x - 7)^2 + (2x + y)(8x - 7)$

40. $(3a - b)^2 - (b + 2a)(b - 3a)$

41. $2(2x - 3)^2 + (2x + 3)(2x - 3)$

42. $3(2m - 5n)^2 + (5n - 2m)(5 - m)$

43. **(a)** Factorize $(h + k)^2 + h^2 + hk$.

(b) Using the result of **(a)**, factorize $(h + k)^2 + h^2 + hk + 2h + k$.

44. **(a)** Factorize $(6x + 5y)^2 - 42xy - 35y^2$.

(b) Using the result of **(a)**, factorize $(6x + 5y)^2 - 42xy - 35y^2 + y - 3x$.

45. **(a)** Factorize $8mn + 6n^2 - 2(4m + 3n)^2$.

(b) Using the result of **(a)**, factorize $4m^2 + 10mn + 6n^2 - 2(4m + 3n)^2$.

46. **(a)** Factorize $x^2 + 5x$.

(b) Using the result of **(a)**, factorize $x^2 + 6x + 5$.

47. **(a)** Factorize $2x^2 + xy$.

(b) Using the result of **(a)**, factorize $2x^2 - 9xy - 5y^2$.

48. **(a)** Factorize $-x^2 + 2x$.

(b) Using the result of **(a)**, factorize $x^3 - 3x^2 + (2 + y)x - 2y$.

49. Factorize $x(x + z) + x(x + y) + xz + x(y + z) + (y + z)z$.

Factorization by Grouping Terms

E.g. Factorize $5x^2 - yz - 5xz + xy$.

$$\begin{aligned} 5x^2 - yz - 5xz + xy &= 5x^2 - 5xz + xy - yz \\ &= 5x(x - z) + y(x - z) \\ &= (x - z)(5x + y) \end{aligned}$$

Exercise 2E

Factorize each of the following expressions. (1 – 28)

1. $2a + ab + 2 + b$

2. $3x - 6 + xy - 2y$

3. $ab + bc - ad - cd$

4. $8p + 6pq + 12r + 9qr$

5. $x^2 - x + xy - y$

6. $2m^2 + 8mn + 3m + 12n$

7. $14a^2b + 21ab^2c - 6ac - 9bc^2$

8. $4a + 3b + 4 + 3ab$

9. $-2x + 4y + xy - 8$

10. $hk - h - h^2 + k$

11. $abc + de + be + acd$

12. $x^3y + x^2y^2 - xz - yz$

13. $2m^2 + 8mn - 3m - 12n$

14. $5p^2 - 3pr - 6qr + 10pq$

15. $21ab - 3a^2 - 42b^2 + 6ab$

16. $4m^2 + 8mn + 6m + 12n$

17. $4p + 12pq + 45pqr + 15pr$

18. $-3ab^2 - 9b^3 - 4a^2 - 12ab$

19. $-x^3 - x^2 - x - 1$

20. $7xy - 42yz^2 - 21xz + 14y^2z$

21. $12ab^2 - 12ac^2 + 8a^2c - 18b^2c$

22. $3a^2b - 5ab^2 - 15a^2 + 25ab$

23. $8(x + 2y) + x^2(x + 2y) - y(x + 2y)$

24. $5(a - 2b + 5c) - ac + 2bc - 5c^2$

25. $(5x - 3y)^2 + 2(5x - 3y) + x(3y - 5x)$

26. $ax + ay - bx - by + cx + cy$

27. $3am - 4bm + 2m - 9an + 12bn - 6n$

28. $3a^2b + 6b^2c + 9a^3 + 18abc - 6a^3b - 12ab^2c$

Factorization by using Identities

For any values of a and b,

$(a + b)(a - b) \equiv a^2 - b^2$

$(a + b)^2 \equiv a^2 + 2ab + b^2$

$(a - b)^2 \equiv a^2 - 2ab + b^2$

Exercise 2F

Factorize each of the following expressions. (1 – 32)

1. $a^2 - 49$

2. $-4 + b^2$

3. $16c^2 - 1$

4. $-1 + 64e^2$

5. $9k^2 - 25$

6. $-121n^2 + 144$

7. $50x^2 - 8$

8. $-363 + 27y^2$

9. $-36 + 81m^2$

10. $9bc^2 - 16b$

11. $28x^3 - 7x$

12. $a^2 - 36b^2$

13. $-144p^2 + q^2$

14. $225x^2 - 49y^2$

15. $-25a^2 + 289b^2$

16. $p^2q^2 - 324$

17. $-p^2q^2 + 400$

18. $5a^2 - 20b^2$

19. $-54x^2 + 96y^2$

20. $4rs^2 - 625rt^2$

21. $a^2b - 256b^3$

22. $-147x^3 + 75xy^2$

23. $-450x^2 + 338y^2z^2$

24. $28a^2b^2 - 252m^2n^2$

25. $(2a - b)^2 - 169$

26. $25x^2 - (x + 4)^2$

27. $2(3y + 2)^2 - 98$

28. $75 - 3(2a - 3)^2$

29. $36m^2 - (5m - 11n)^2$

30. $-(5p + 9q)^2 + (7p - 2q)^2$

31. $4(3x + 2y)^2 - (6x - 8y)^2$

32. $98ab^2 - 2a(3a + 2b)^2$

33. **(a)** Factorize $a^2 - b^2$.

(b) Using the result of **(a)**, factorize $x^4 - y^4$.

(c) Using the result of **(b)**, factorize $(m + n)^4 - (m - n)^4$.

Factorization by using Identities

For any values of a and b,

$(a + b)(a - b) \equiv a^2 - b^2$

$(a + b)^2 \equiv a^2 + 2ab + b^2$

$(a - b)^2 \equiv a^2 - 2ab + b^2$

Exercise 2G

Factorize each of the following expressions.

1. $x^2 + 14x + 49$

2. $y^2 - 6y + 9$

3. $a^2 + 4 + 4a$

4. $-10b + 25 + b^2$

5. $64 + n^2 + 16n$

6. $121 - 22m + m^2$

7. $16p^2 + 8p + 1$

8. $1 - 20q + 100q^2$

9. $4s^2 + 28s + 49$

10. $25t^2 - 90t + 81$

11. $208v + 64 + 169v^2$

12. $81u^2 + 64 - 144u$

13. $196 - 84y + 9y^2$

14. $120x + 16x^2 + 225$

15. $289s^2 - 34st + t^2$

16. $9a^2 + 361b^2 + 114ab$

17. $25p^2 + 121q^2 - 110pq$

18. $x^2y^2 + 6xyz + 9z^2$

19. $-20abc + 4a^2 + 25b^2c^2$

20. $4x^2 + 16x + 16$

21. $125k^2 - 50k + 5$

22. $-49m^2 - 112m - 64$

23. $400x^2 + 200xy + 25y^2$

24. $27a^2 - 198ab + 363b^2$

25. $-144m^2n + 120mn - 25n$

26. $-8x^2 - 56xy - 98y^2$

27. $-27m^3 + 72m^2n - 48mn^2$

28. $-450s^2 - 8t^2 - 120st$

29. $(2k - 1)^2 + 2(2k - 1) + 1$

30. $(4a - 3)^2 - 8(3 - 4a) + 16$

31. $-(5a - 1)^2 - 12a(5a - 1) - 36a^2$

32. $49x^2 - 14x(5x - 3y) + (5x - 3y)^2$

33. $243n^2 - 54n(4m + 5n) + 3(4m + 5n)^2$

34. $-(2p - 7q)^2 + 10q(2p - 7q) - 25q^2$

35. **(a)** Factorize $4x^2 + 12xy + 9y^2$.

(b) Factorize $25x^2 - 40xy + 16y^2$.

(c) Using the results of **(a)** and **(b)**, factorize $21x^2 - 52xy + 7y^2$.

36. **(a)** Factorize $a^2 - 2a + 1$.

(b) Using the result of **(a)**, factorize $a^4 - 2a^2 + 1$.

37. **(a)** Factorize $x^2 + 12xy + 36y^2$.

(b) Using the result of **(a)**, factorize $(h + 2)^2 + 12(h + 1)(h + 2) + 36(h + 1)^2$.

38. **(a)** Factorize $25x^2 - 20xy + 4y^2$.

(b) Using the result of **(a)**, factorize $25(p + q)^2 - 20(p + q)(p - q) + 4(p - q)^2$.

39. **(a)** Factorize $a^3 + 2a^2 + a$.

(b) Using the result of **(a)**, factorize $x^3 + 3x^2 + 3x + 1$.

Paper II

1. Which of the following is an identity?

   A. $2x+6x^2=2(x^2+3x)$
   B. $2x+6x^2=2(1+3x)^2$
   C. $2x+6x^2=3x(x+2)$
   D. $2x+6x^2=2(x+3x^2)$

2. Which of the following are identities?

   I. $2(9x-6y)=3(6x-4y)$
   II. $x(x+y)=x^2+xy$
   III. $x^2+y^2=(x+y)^2$
   A. I and II only
   B. I and III only
   C. II and III only
   D. I, II and III

3. If $2(3x-4)\equiv Ax+B$, then

   A. $A=3,\ B=4$.
   B. $A=3,\ B=-4$.
   C. $A=6,\ B=8$.
   D. $A=6,\ B=-8$.

4. If $2x^2+Ax+B\equiv(x+3)(2x-1)$, then

   A. $A=5,\ B=-3$.
   B. $A=5,\ B=3$.
   C. $A=7,\ B=-3$.
   D. $A=7,\ B=3$.

5. $(x+5y)^2 =$

A. x^2+25y^2
B. $x^2+10xy+10y^2$
C. $x^2+10xy+25y^2$
D. $x^2+25xy+10y^2$

6. $(3a-4b)^2 =$

A. $9a^2-16b^2$
B. $9a^2+16b^2$
C. $9a^2-12ab+16b^2$
D. $9a^2-24ab+16b^2$

7. $(3x+y)(-3x+y) =$

A. $9x^2+6xy+y^2$
B. $9x^2-6xy+y^2$
C. $9x^2-y^2$
D. y^2-9x^2

8. Which of the following are factors of $6ab^2-16ab$?

I. 6
II. a
III. b^2
IV. $3b-8$

A. I and III only
B. II and IV only
C. I, II and IV only
D. I, III and IV only

9. Factorize $4xy - 10yz + 20xyz$.

A. $2x(2y - 5z + 10yz)$
B. $2y(2x - 5z + 10xz)$
C. $4x(y - 2z + 5yz)$
D. $4y(x - 2z + 5xz)$

10. Factorize $a(b + c) - b(b + c)$.

A. $(b + c)(a - b)$
B. $(b - c)(a - b)$
C. $(b + c)(a + b)$
D. $(b - c)(a + b)$

11. Factorize $12xy + 4x - 3y - 1$.

A. $(4y + 1)(3x - 1)$
B. $(4y - 1)(3x + 1)$
C. $(3y + 1)(4x - 1)$
D. $(3y - 1)(4x + 1)$

12. Factorize $3x^2 - 48$.

A. $3(x + 4)(x - 4)$
B. $3(x + 4)^2$
C. $3(x - 4)^2$
D. $3(x^2 + 16)$

13. Factorize $4x^2 - 40x + 100$.

A. $(2x - 10)^2$
B. $4(x - 5)^2$
C. $(x - 5)^2$
D. $(x - 10)^2$

14. Factorize $5x^2 + 30xy + 45y^2$.

A. $5(x+3y)^2$
B. $5(2x+6y)^2$
C. $20(x+3y)^2$
D. $(20x+3y)^2$

15. Factorize $(x+y)^2 - 6(x+y) + 9$.

A. $(x+y-3)^2$
B. $(x-y+3)^2$
C. $(x+y+3)^2$
D. $(x+y)(x+y+3)$

16. Which of the following is an identity?

A. $2a = 2 + a$
B. $3b - 1 = -(1-3b)$
C. $2c + 3 = 3 - 2c$
D. $5d - 8d = 3d$

17. Which of the following is an identity?

A. $3(x-1) = 3x - 1$
B. $2(2x+1) = 4\left(x + \frac{1}{4}\right)$
C. $2x + 3 = 3(1-x) + x$
D. $-4(2-x) = 4x - 8$

18. Which of the following is an identity?

A. $(2x+1)(x-3) = 2x^2 - 5x + 3$
B. $(2x+1)(x+3) = 2x^2 - 7x + 3$
C. $(2x-1)(x-3) = 2x^2 + 7x - 3$
D. $(2x-1)(x+3) = 2x^2 + 5x - 3$

19. Which of the following is **NOT** an identity?

A. $5(6-7x) = 30-35x$

B. $2(x-3)+3(2x+5) = 7x+9$

C. $2(3x+6) = 3(2x+4)$

D. $4(x^2+x)+2 = x(4x+4)+2$

20. Which of the following is **NOT** an identity?

A. $(x-2)(x-1) = x^2-3x+2$

B. $(x-2)(x+1) = x^2+3x-2$

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

D. $(x+2)(x+1) = x^2+3x+2$

21. Which of the following is **NOT** an identity?

A. $(x-2)^2 = x^2-4x-4$

B. $(2x+3)^2 = 4x^2+12x+9$

C. $(3x-4)^2 = 9x^2-24x+16$

D. $(4x+5)^2 = 16x^2+40x+25$

22. If $-x^2+2 \equiv Ax^2+Bx+C$, then

A. $A=1$, $B=0$ and $C=2$.

B. $A=1$, $B=2$ and $C=0$.

C. $A=-1$, $B=0$ and $C=2$.

D. $A=-1$, $B=2$ and $C=0$.

23. If $(x+4)(3x-5) \equiv Ax^2+Bx+C$, then

A. $A=3$, $B=-7$ and $C=-20$.

B. $A=3$, $B=-7$ and $C=20$.

C. $A=3$, $B=7$ and $C=-20$.

D. $A=-3$, $B=7$ and $C=20$.

24. If $(x+2)(x+A)-4 \equiv x^2+B$, then $B =$

A. -8.
B. -4.
C. -2.
D. 0.

25. It is given that $x^2+Ax+6 \equiv (x+B)(x+C)$, where B and C are integers. Which of the following **CANNOT** be the value of A?

A. -7
B. 5
C. 6
D. 7

26. Which of the following is an identity/are identities?

I. $2(5x-7)-3(3x-4) = x+2$
II. $(1-x)(2x+5) = -2x^2-3x+5$
III. $(10x-1)^2 = 100x^2-20x+1$

A. II only
B. III only
C. II and III only
D. I, II and III

27. Which of the following are **NOT** identities?

I. $4x^2-25y^2 = (-2x+5y)(2x+5y)$
II. $4x^2-10xy+25y^2 = (2x-5y)^2$
III. $-4x^2-20xy-25y^2 = (-2x-5y)(2x+5y)$

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

28. $(6-x)(6+x) =$

A. $x^2 - 36.$
B. $36 - x^2.$
C. $x^2 + 36.$
D. $-36 - x^2.$

29. $(2x+25)(2x-25) =$

A. $2x^2 - 625.$
B. $2x^2 + 625.$
C. $4x^2 - 625.$
D. $4x^2 + 625.$

30. $(3m+2n)(3m-2n) =$

A. $3m^2 - 2n^2.$
B. $9m^2 - 4n^2.$
C. $9m^2 + 4n^2.$
D. $4n^2 - 9m^2.$

31. $(-12+y)(12+y) =$

A. $144 - y^2.$
B. $-144 - y^2.$
C. $y^2 - 144.$
D. $y^2 + 144.$

32. $(-11-qr)(11-qr) =$

A. $121 + q^2r^2.$
B. $121 - q^2r^2.$
C. $-q^2r^2 - 121.$
D. $q^2r^2 - 121.$

33. $\left(x^2+\frac{3}{4}\right)\left(x^2-\frac{3}{4}\right)=$

A. $x^2-\frac{9}{16}$.

B. $x^4-\frac{3}{8}$.

C. $x^4-\frac{9}{16}$.

D. $x^4-\frac{3}{2}$.

34. $7(a+2b)(a-2b)=$

A. $-7a^2-28b^2$.

B. $-7a^2+28b^2$.

C. $7a^2-28b^2$.

D. $7a^2+28b^2$.

35. $-(ab+c)(c-ab)=$

A. $a^2b^2-c^2$.

B. $c^2-a^2b^2$.

C. $-a^2b^2-c^2$.

D. $a^2b^2+c^2$.

36. $18\left(\frac{x}{2}-\frac{y}{3}\right)\left(\frac{x}{2}+\frac{y}{3}\right)=$

A. $9x^2-6y^2$.

B. $18x^2-18y^2$.

C. $\frac{9x^2}{2}-3y^2$.

D. $\frac{9x^2}{2}-2y^2$.

37. $100(0.1x-3y)(0.1x+3y) =$

A. $10x^2-900y^2$.
B. x^2-900y^2.
C. $10x^2-300y^2$.
D. x^2-300y^2.

38. $(2x+3)(2x-3)-(-2-3x)(2-3x) =$

A. $-5x^2-5$.
B. $5x^2+5$.
C. $-5x^2+13$.
D. $-13x^2-5$.

39. $(8-x)^2 =$

A. $8-8x+x^2$.
B. $8-16x+x^2$.
C. $64-8x+x^2$.
D. $64-16x+x^2$.

40. $(3y+11)^2 =$

A. $9y^2+121$.
B. $9y^2+33y+121$.
C. $9y^2+66y+121$.
D. $6y^2+66y+22$.

41. $(-a-3b)^2 =$

A. $-a^2-9b^2$.
B. $-a^2-6ab-9b^2$.
C. $a^2-6ab+9b^2$.
D. $a^2+6ab+9b^2$.

42. $-(4r-s)^2 =$

A. $16r^2-8rs+s^2.$
B. $-16r^2-8rs+s^2.$
C. $-16r^2+8rs-s^2.$
D. $16r^2+8rs+s^2.$

43. $\left(\frac{m}{8}+4\right)^2 =$

A. $\frac{m^2}{64}+m+16.$
B. $\frac{m^2}{64}+\frac{m}{2}+16.$
C. $\frac{m^2}{16}+m+16.$
D. $\frac{m^2}{16}+2m+16.$

44. $(7v^2-v)^2 =$

A. $36v^2.$
B. $50v^2-14v^3.$
C. $49v^4-7v^3+v^2.$
D. $49v^4-14v^3+v^2.$

45. $-3(5a-3b)^2 =$

A. $75a^2-90ab+27b^2.$
B. $-75a^2+90ab-27b^2.$
C. $-75a^2+45ab-27b^2.$
D. $-75a^2-30ab+9b^2.$

46. $[-2(2x-3y)]^2 =$

A. $16x^2-48xy+36y^2$.

B. $-16x^2+48xy-36y^2$.

C. $-8x^2+24xy-18y^2$.

D. $8x^2-24xy+18y^2$.

47. $\frac{1}{5}(5x^2+10)^2 =$

A. x^4+2x^2+4.

B. x^4+4x^2+4.

C. $5x^4+10x^2+20$.

D. $5x^4+20x^2+20$.

48. $(6x-1)^2+(6x+1)^2 =$

A. $72x^2+2$.

B. $72x^2-2$.

C. $24x$.

D. $-24x$.

49. $20x-25y =$

A. $5(4x-5y)$.

B. $5(4x-25y)$.

C. $5xy(4y-5x)$.

D. $20(x-5y)$.

50. $84ab-7bc =$

A. $7b(12a-c)$.

B. $7ab(12-ac)$.

C. $7abc(12c-a)$.

D. $84b(a-12c)$.

51. $30wx^2 + 18wy - 6wz =$

A. $-6w(5x^2 + 3y + z).$
B. $6w(5x^2 + 3y - z).$
C. $6w(5x^2 + 3y + z).$
D. $42w(x^2 + y - z).$

52. $-8mn^2 - 16n =$

A. $-8n(mn - 2).$
B. $-8n(mn + 2).$
C. $-8n(mn + 16).$
D. $-16n(2mn + 1).$

53. $14x^4y^3 + 18x^2y =$

A. $2x^2y(7xy^2 + 9).$
B. $2x^2y(7x^2y^2 + 9).$
C. $2xy(7xy^2 + 9).$
D. $2xy(7x^3y^2 + 9x^2y).$

54. $-10a^3 + 14a^2 + 4a =$

A. $-2a^3(5 - 7a - 2a^2).$
B. $-2a^3(5 + 7a + 2a^2).$
C. $-2a(5a^2 - 7a - 2).$
D. $-2a(5a^2 + 7a + 2).$

55. $21m^2n - 15mn^3 + 27m^2n^2 =$

A. $3m^2n^3(7n^2 - 5m + 9n).$
B. $3m^2n(7 - 5mn^2 + 9n).$
C. $3mn(7m - 5n^2 + 9n).$
D. $3mn(7m - 5n^2 + 9mn).$

56. $(3x-2)(x+3)+x+3=$

A. $(x+3)(3x-2)$.
B. $(x+3)(3x-1)$.
C. $2(x+3)(3x-2)$.
D. $3(x+3)(x-1)$.

57. $5(x+y)^2-10(x+y)z=$

A. $5(x+y)(x+y+2z)$.
B. $5(x+y)(x-y-2z)$.
C. $5(x+y)(x-y+2z)$.
D. $5(x+y)(x+y-2z)$.

58. If $a^4b=-16$ and $a+4b^2=6$, then $-2a^5b-8a^4b^3=$

A. –192.
B. –96.
C. 96.
D. 192.

59. $p-q+pr-qr=$

A. $r(p-q)$.
B. $(p-q)(1-r)$.
C. $(p-q)(1+r)$.
D. $(p+q)(1-r)$.

60. $xy+xz-7y-7z=$

A. $(y-z)(x-7)$.
B. $(y-z)(x+7)$.
C. $(y+z)(x-7)$.
D. $(z-y)(x-7)$.

61. $2ac+14a-bc-7b=$

A. $(c+7)(2a-b)$.
B. $(c-7)(2a+b)$.
C. $(c+7)(2a+b)$.
D. $(c-7)(2a-b)$.

62. $ab-2cd-2bc+ad=$

A. $(a+2c)(b+d)$.
B. $(a-2c)(b+d)$.
C. $(a+2c)(b-d)$.
D. $(a-2c)(b-d)$.

63. $-4ax-3by-3bx-4ay=$

A. $(x-y)(4a-3b)$.
B. $(x-4a)(y-3b)$.
C. $-(x+y)(4a+3b)$.
D. $-(x+4a)(y+3b)$.

64. $x^2-4x+6x-24=$

A. $(x+2)(x-12)$.
B. $(x-4)(x-6)$.
C. $(x+4)(x-6)$.
D. $(x-4)(x+6)$.

65. $5n^3+5n^2+n+1=$

A. $(n^2+1)(5n+1)$.
B. $(n+1)(5n^2+1)$.
C. $n(n+1)(5n+1)$.
D. $5(n+1)(n^2+1)$.

66. $2x^2 + 8x - 12 - 3x =$

A. $(x-4)(2x-3)$.
B. $(x+4)(2x+3)$.
C. $(x-4)(2x+3)$.
D. $(x+4)(2x-3)$.

67. $5a - 15a^2 - 21ab + 7b =$

A. $(1-5b)(3a+7b)$.
B. $(1-3a)(5a-7b)$.
C. $(1+3a)(5a-7b)$.
D. $(1-3a)(5a+7b)$.

68. $ax - 4bx + ay - 4by + a - 4b =$

A. $(x+y)(a-b-4)$.
B. $(4x-y)(a+b+1)$.
C. $(a-4b)(x+y+1)$.
D. $(a+4b)(x-y-1)$.

69. $3x^2 + 8y + 6x + 4xy + 5xz + 10z =$

A. $(x+5)(3x+4y+2z)$.
B. $(3x+5)(x+4y+2z)$.
C. $(x+2)(3x+4y+5z)$.
D. $(3x+2)(x+4y+5z)$.

70. Which of the following is/are factor(s) of $8x^2 - 12x + 6x - 9$?

I. $2x + 3$
II. $2x - 3$
III. $4x + 3$

A. II only
B. III only
C. I and III only
D. II and III only

71. Which of the following are **NOT** factors of $6xz - 3x - 3y + 6yz$?

I. 6
II. $x - y$
III. $2z - 1$

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

72. Which of the following expressions have a factor $2x + 1$?

I. $2xy + 2xz + y + z$
II. $2x^3 - x^2 + 4x - 2$
III. $4x^2 - 6x - 3 + 2x$

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

73. $p^2 - 169 =$

A. $(p+169)(p-169)$.
B. $(p+13)(p-13)$.
C. $(p-169)^2$.
D. $(p-13)^2$.

74. $16 - a^2b^2 =$

A. $(4a+b)(4a-b)$.
B. $(a+4b)(a-4b)$.
C. $(4+ab)(4-ab)$.
D. $(1+4ab)(1-4ab)$.

75. $81x^2 - 4y^4 =$

A. $(9x-2y)^2$.
B. $(9x-2y^2)^2$.
C. $(9x+2y)(9x-2y)$.
D. $(9x+2y^2)(9x-2y^2)$.

76. $147 - 3q^2 =$

A. $(147+3q)(147-3q)$.
B. $3(49+q)(49-q)$.
C. $3(7+3q)(7-3q)$.
D. $3(7+q)(7-q)$.

77. $27x^2 - 12y^2 =$

A. $(27x+12y)(27x-12y)$.
B. $3(3x+2y)(3x-2y)$.
C. $3(3x+2y)^2$.
D. $3(3x-2y)^2$.

78. $100-(4-a)^2=$

A. $(14-a)(6+a)$.
B. $(6-a)(14+a)$.
C. $(12-a)(8+a)$.
D. $(8-a)(12+a)$.

79. $(x-5)^2-(4-3x)^2=$

A. $(2x+1)(4x+9)$.
B. $-(2x+1)(4x+9)$.
C. $-(2x-1)(4x-9)$.
D. $-(2x+1)(4x-9)$.

80. $25(y+1)^2-4(2y-1)^2=$

A. $9y(y+2)$.
B. $3(3y+1)(y+3)$.
C. $3(3y+1)(y+7)$.
D. $3(11y+7)(17y+29)$.

81. $g^2-4h^2-3g+6h=$

A. $(g-2h)(g+2h-3)$.
B. $(g-2h)(g+2h+3)$.
C. $(g+2h)(g-2h-3)$.
D. $(g+2h)(g-2h+3)$.

82. $1-625x^4=$

A. $(1+25x^2)(1+5x)(1-5x)$.
B. $(1+25x^2)(1+25x)(1-25x)$.
C. $(1+25x)(1-25x)(1+x^2)$.
D. $(1+5x)^2(1-5x)^2$.

83. Which of the following is/are factor(s) of $4-16n^2$?

I. 4
II. $1+2n$
III. $1+4n$

A. I only
B. III only
C. I and II only
D. I and III only

84. Which of the following has/have a factor $n+m$?

I. m^2-n^2
II. $(m+n)^2-1$
III. $n^2+4n+4m-m^2$

A. I only
B. III only
C. I and II only
D. I and III only

85. Which of the following are **NOT** factors of $(x^2+y^2)^2-4y^4$?

I. x^2+y^2
II. $x+y$
III. $x-2y$

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

86. $h^2 + 16h + 64 =$

A. $(h+32)^2$.

B. $(h+8)^2$.

C. $(h-4)(h-16)$.

D. $(h+4)(h+16)$.

87. $25m^2 - 20m + 4 =$

A. $(25m-4)^2$.

B. $(5m+2)^2$.

C. $(5m-2)^2$.

D. $(5m+2)(5m-2)$.

88. $9p^2 + 42pq + 49q^2 =$

A. $(3p+7q)^2$.

B. $(9p+7q)^2$.

C. $3(p+7q)^2$.

D. $9(p+7q)^2$.

89. $25p^2 + 36q^2 + 60pq =$

A. $5(p+6q)^2$.

B. $5(p-6q)^2$.

C. $(5p+6q)^2$.

D. $(5p-6q)^2$.

90. $\frac{1}{4}+y+y^2=$

A. $\left(\frac{1}{16}+y\right)^2$.

B. $\left(\frac{1}{4}+y\right)^2$.

C. $\left(\frac{1}{2}+y\right)^2$.

D. $\left(\frac{1}{2}-y\right)^2$.

91. $81x^2-54x+9=$

A. $3(3x-1)^2$.

B. $3(9x-1)^2$.

C. $9(3x-1)^2$.

D. $9(9x-1)^2$.

92. $-64x^2-96x-36=$

A. $4(-4x-3)^2$.

B. $4(4x-3)^2$.

C. $-4(4x-3)^2$.

D. $-4(4x+3)^2$.

93. $28k^3+175k-140k^2=$

A. $7(2k-5)^2$.

B. $7k(2k-5)^2$.

C. $7k(4k-5)^2$.

D. $28k(k-5)^2$.

94. $81(r+s)^2-36(r+s)+4=$

A. $(9r+9s+2)^2$.

B. $(9r+9s-2)^2$.

C. $(9r-9s+2)^2$.

D. $(9r-9s-2)^2$.

95. $r^2+20rs+100s^2-100t^2=$

A. $(r+10s-t)^2$.

B. $(r+10s+t)(r+10s-t)$.

C. $(r-10s+10t)(r-10s-10t)$.

D. $(r+10s+10t)(r+10s-10t)$.

96. If $m+n=4$ and $m-n=2$, then $m^4-2m^2n^2+n^4=$

A. 8.

B. 64.

C. 272.

D. 1 296.

97. Which of the following is/are factor(s) of $112x^2+7y^2-56xy$?

I. 7

II. $4x-y$

III. $4x+y$

A. I only

B. II only

C. I and II only

D. I, II and III