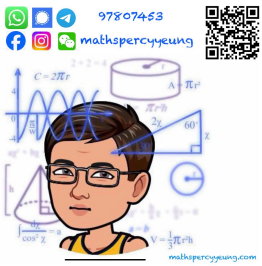
TT S2 SBE Ch3 Algebraic Fractions and Formulas Q



Paper I

Simplifying Algebraic Fractions, Multiplication and Division of Algebraic Fractions

An algebraic fraction can be simplified by cancelling out common factor(s) of the numerator and the denominator.

Example

Simplify the algebraic fraction $\frac{14mn}{35m^3n}$.

Solution

$$\frac{14mn}{35m^3n} = \frac{(7mn)(2)}{(7mn)(5m^2)}$$

$$= \frac{2}{5m^2}$$

Given two algebraic fractions $\frac{P}{Q}$ and $\frac{R}{S}$, we have $\frac{P}{Q}\times\frac{R}{S} = \frac{P\times R}{Q\times S}$ and $\frac{P}{Q}\div\frac{R}{S} = \frac{P}{Q}\times\frac{S}{R} = \frac{P\times S}{Q\times R}$.

Common factors of the resulting numerator and denominator can then be cancelled out for simplification.

Example

Simplify $\frac{2pq}{a}\times\frac{5x}{b}$.

Solution

$$\frac{2pq}{a}\times\frac{5x}{b} = \frac{(2pq)\times(5x)}{ab}$$

$$= \frac{10pqx}{ab}$$

Exercise 3A

Simplify each of the following algebraic fractions. **(1 - 42)**

1. $\frac{18p}{9q}$

2. $\frac{27x}{18y}$

3. $\frac{6ab}{12b}$

4. $\frac{15abc}{24b}$

5. $\frac{2k^4}{8k}$

6. $\frac{35t^5}{45t^2}$

7. $\frac{15x^2y}{3xy^3}$

8. $\frac{13b^3c}{39ab}$

9. $\frac{216x^2y^3}{36xz^2}$

10. $\frac{28ab^2}{63a^2b^5}$

11. $\frac{54p^2q}{24q^2r}$

12. $\frac{255y^2z^3}{68x^5z^4}$

13. $\frac{12(x+y)}{3(x-y)}$

14. $\frac{9x(3x-y)}{15(3x-y)}$

15. $\frac{6(p-d)}{9(d-p)}$

16. $\frac{2x(1-x)}{6(x-1)}$

17. $\frac{(a+b)^2}{3(a+b)}$

18. $\frac{(a-b)(3a+3)}{6(a-b)}$

19. $\frac{2a+4b}{8a}$

20. $\frac{10x-xy}{5x}$

21. $\frac{-6m+2mn}{8m}$

22. $\frac{x^2y+x^2z}{xyz}$

23. $\frac{4a+6b}{8a+10b}$

24. $\frac{6bc-9bd}{12d-8c}$

25. $\frac{4x^2y^3-6xy^2}{2xyz-3z}$

26. $\frac{4m-4n}{mn^3-m^2n^2}$

27. $\frac{2a^2+12a+18}{2a+6}$

28. $\frac{2m+6n}{m^2-9n^2}$

29. $\frac{b^2-4b+4}{b^2-2b}$

30. $\frac{9x^2+6xy+y^2}{9x^2-y^2}$

31. $\frac{p(3q-2)-(2-3q)}{4p^2-4}$

32. $\frac{ac-ad+bc-bd}{3c-3d}$

33. $\frac{2ab+2ad}{abc+ab+acd+ad}$

34. $\frac{24r-18}{3pq-6-4pqr+8r}$

35. $\dfrac{xz-x^2}{4xy+x-4yz-z}$

36. $\dfrac{3n+3m^2n}{m^3+2m^2+m+2}$

37. $\dfrac{2x^2-5xy-4x+10y}{xy+4x-2y-8}$

38. $\dfrac{-3mn^2-9n^3-2m^2-6mn}{2m^2+12mn+18n^2}$

39. $\dfrac{3x^2-3y^2-2x-2y}{10x-15x^2+15xy}$

40. $\dfrac{(3a+2b)(5a-b)+(3a+2b)(a-5b)}{(a+b)(4a+3)-3(a+b)}$

41. Simplify $\dfrac{4a^2-9c^2}{6ab^2-6ac^2+4a^2c-9b^2c}$.

42. Simplify $\dfrac{x^2+x-y-y^2}{x^2+2xy+y^2-1}$.

43. $\dfrac{15a}{2b^2}\times\dfrac{14b}{5a}$

44. $\dfrac{2p}{15q^3}\div\dfrac{8p^2}{9q}$

45. $\dfrac{28c}{3d^2}\times\dfrac{6cd^3}{7}$

46. $\dfrac{2t}{24s^2}\div\dfrac{st^4}{6}$

47. $\dfrac{4x}{3(x-y)}\times\dfrac{5(x-y)}{6xy}$

48. $\dfrac{2m+1}{3n^3}\div\dfrac{5(2m+1)}{6n}$

49. $\dfrac{5(x+y)}{4y^3}\times\dfrac{12x^2y}{25x(x+y)}$

50. $\dfrac{b-a}{4ab^3}\div\dfrac{3(a-b)}{8a^2b}$

51. $\dfrac{8p^2}{3q^3}\times\dfrac{9p^2}{5q}\times\dfrac{q^2}{4p}$

52. $\dfrac{-ab}{2c}\div\dfrac{6b}{-c}\div\dfrac{4c^2}{3a}$

53. $\dfrac{4x-y}{9x^3}\times\dfrac{3(x-y)}{4(4x-y)}\times\dfrac{5xy}{4(x-y)}$

54. $\dfrac{-4m}{15(m-2n)}\div\dfrac{2(m-2n)}{-9mn}\div\dfrac{-3m^2}{m-2n}$

55. $\dfrac{2x+4}{10x}\times\dfrac{15x^2y}{3x+6}$

56. $\dfrac{pq-p^2}{6q}\div\dfrac{pq-q^2}{9p}$

57. $\dfrac{m^2n+mn}{m^2+1}\times\dfrac{4m^2+4}{6mn+6n}$

58. $\dfrac{2+6y}{xy-3x}\div\dfrac{-3x-9xy}{12x}$

59. $\dfrac{14(a+1)^3}{3a} \times \dfrac{6ab^2}{4(a+1)^2} \div 7ab$

60. $\dfrac{a^2b+2ab}{6a-12} \div \dfrac{2ab+4b}{3b} \times 7ab$

61. $\dfrac{2(m+3)}{3m+3} \div (m+3)^2 \times \dfrac{m^2n+mn}{n^2}$

62. $\dfrac{2(z-x)}{x^2yz-2xyz^2} \times 3x^2yz^3 \div \dfrac{-2x}{x-2z}$

63. $\dfrac{pq-pr}{2qr-2pr} \times (-4q^2r) \times \dfrac{q^2-pq}{3qr-3q^2}$

64. $\dfrac{-2y}{5x^2z} \div \dfrac{x+3}{xyz} \div \dfrac{2x+6}{5x^2}$

Addition and Subtraction of Algebraic Fractions

Example

Simplify $\frac{a}{a+1}+\frac{a-2}{a+1}$.

Solution

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

Exercise 3B

Simplify each of the following expressions. (1 –)

1. $\frac{5}{2x}+\frac{3}{2x}$

2. $\frac{4}{z-6}-\frac{5}{z-6}$

3. $\frac{8}{5y}+\frac{3}{20y}$

4. $\frac{4}{3a}-\frac{5}{a}$

5. $\frac{3}{5ab}+\frac{1}{15ab}$

6. $-\frac{2n}{3m^2}-\frac{n}{12m^2}$

7. $\frac{6}{a-b}+\frac{2}{b-a}$

8. $\frac{2z}{z-1}-\frac{5}{1-z}$

9. $\frac{6z}{3z-2}-\frac{7z}{2-3z}$

10. $\frac{4s}{2s-t}+\frac{2t}{t-2s}$

11. $\frac{3p}{p+q}-\frac{-5p}{4(p+q)}$

12. $\frac{3c+2d}{c+d}+\frac{14d}{3(c+d)}$

13. $\frac{2b}{a}+\frac{3}{b}$

14. $\frac{3}{c}-\frac{2}{c+2}$

15. $\frac{4}{1-3k}+\frac{1}{2k}$

16. $\frac{2}{c-1}-\frac{3}{c+2}$

17. $\frac{3}{4p}-\frac{1}{6p}$

18. $\frac{2}{5q}+\frac{1}{3q}$

19. $\frac{1}{6(m-2)}+\frac{3}{8(m-2)}$

20. $\frac{1}{4(1-n)}-\frac{5}{10(1-n)}$

21. $\frac{4}{9(2-x)}-\frac{5}{6(x-2)}$

22. $\frac{3}{16(1-3y)}+\frac{1}{12(3y-1)}$

23. $5+\frac{1}{a-3}$

24. $\frac{3}{2a+1}+4$

25. $2-\frac{z}{z-3}$

26. $\frac{a+b}{a-b}-3$

27. $2+\frac{1}{4k}-\frac{2}{3k}$

28. $\frac{3}{5h}-\frac{1}{2}+\frac{1}{4h}$

29. $\frac{1}{4(x-y)}-\frac{2}{3(x-y)}+\frac{3}{8(x-y)}$

30. $\frac{x}{3(x+y)}-\frac{y}{5(x+y)}-2$

31. **(a)** Simplify $\frac{1}{y}-\frac{1}{y+1}$.

(b) Hence, simplify $\frac{1}{x(x+1)}+\frac{1}{(x+1)(x+2)}+\frac{1}{(x+2)(x+3)}+\frac{1}{(x+3)(x+4)}$.

32. Simplify $1-\frac{1}{1+\frac{1}{x-1}}$.

Find the Value of a Variable in a Formula by Using Substitution

A formula is an algebraic equality which states a relation among two or more variables. The value of a variable in a formula can be found by substitution when the values of other variables are known.

Example

It is given that $b = 2(a + 1)$.
If $b = 20$, find a.

Solution

Put $b = 20$ into $b = 2(a + 1)$.

$20 = 2(a + 1)$
$10 = a + 1$
$a = 9$

Exercise 3C

1. It is given that $A = 4\pi r^2$. If $r = 14$, find A. (Take $\pi = \frac{22}{7}$.)

2. It is given that $E = mc^2$. If $m = 14$ and $c = 3$, find E.

3. It is given that $F = \frac{mv^2}{r}$. If $m = 1.6$, $v = 5$ and $r = 0.2$, find F.

4. It is given that $A = P(1+\frac{RT}{100})$. If $P = 3000$, $R = 10$ and $T = 2.5$, find the value of A.

5. It is given that $S = \frac{n}{2}[2a+(n-1)d]$. If $a = 3$, $d = 2$ and $n = 19$, find the value of S.

6. It is given that $D = b^2 - 4ac$. If $a = 2$, $b = -7$ and $c = 5$, find the value of D.

7. Consider the formula $S = \left[\frac{n(n+1)}{2}\right]^2$. If $n = 5$, find the value of S.

8. Consider the formula $C = \frac{5}{9}(F-32)$. If $F = 104$, find the value of C.

9. Consider the formula $A = \sqrt{(p-a)(p-b)(p-c)(p-d)}$, where $p = \frac{a+b+c+d}{2}$.

If $a = 20$, $b = 15$, $c = 7$ and $d = 24$, find the values of p and A.

10. It is given that $K = 273 + C$. If $K = 124$, find the value of C.

11. It is given that $R = \dfrac{PL}{A}$. If $R = 14$, $L = 15$ and $A = 1.2$, find P.

12. It is given that $P = 2(l + b)$. If $P = 24$ and $l = 7$, find the value of b.

13. It is given that $V = \pi r^2 h$. If $V = 24\pi$ and $r = 6$, find the value of h.

14. It is given that $A = 2\pi r(r + h)$. If $A = 9\pi$ and $r = 1.2$, find the value of h.

15. It is given that $A + B + C = 180$. If $A = 34$ and $C = 53$, find the value of B.

16. It is given that $nR = \dfrac{PV}{T}$. If $n = 2$, $R = 8$, $P = 3$ and $T = 300$, find the value of V.

17. It is given that $P = C[1 + (g - i)a]$. If $P = 120$, $C = 100$, $i = 0.1$ and $a = 20$, find the value of g.

18. The monthly rent \$$R$ of a flat of area A m^2 can be calculated by the formula $R = 112A$.

(a) If $A = 45$, find the value of R.

(b) If $R = 7700$, find the value of A.

19. In a library, the overdue fine \$$F$ for late return of a book can be calculated by the formula

$$F = 10 + d \times 1.5,$$

where d is the number of days of late return after the due date.

(a) Find the overdue fine if a book is returned 1 week after the due date.

(b) If the overdue fine is \$43, find the number of days of late return after the due date.

20. The price \$$P$ of a dinner in a restaurant can be calculated by the formula

$$P = 10m + 57n,$$

where m is the number of people and n is the number of courses ordered.

(a) Find the price of a dinner in the restaurant if a family of four members orders 3-course meals.

(b) Jack had a dinner with two friends in the restaurant. If each of them paid \$105, find the number of courses ordered.

21. The Body Mass Index (BMI) of a person can be calculated by the formula

$$\text{BMI} = \frac{w}{h^2},$$

where w (in kg) is the weight and h (in m) is the height of the person.

(a) If the BMI of a person of height 1.7 m is 19.5, find the weight of the person.

(b) The table below shows the weight status categories associated with BMI ranges.

BMI	18.4 or below	18.5 – 24.9	25.0 – 29.9	30.0 or above
Weight status	Underweight	Normal	Overweight	Obese

What is the weight status of Tom if his weight and height are 70 kg and 165 cm respectively?

22. It is given that $t = \dfrac{72}{100r}$. If $t = \dfrac{3}{5}$, find the value of r.

23. It is given that $v = \dfrac{1}{1+it}$. If $v = \dfrac{15}{16}$ and $t = 2$, find the value of i.

24. It is given that $A = \dfrac{1}{i-k}$. If $A = 12$ and $i = \dfrac{1}{3}$, find the value of k.

25. It is given that $y = b - \dfrac{bx}{a}$. If $b = 8$, $x = -3$ and $y = 4$, find the value of a.

26. It is given that $R = \dfrac{i}{1+(n-1)i}$. If $R = 0.025$ and $n = 21$, find the value of i.

27. It is given that $x = \dfrac{x_1 + rx_2}{1+r}$.

(a) If $x = 0.6$, $r = 2$ and $x_1 = 5$, find the value of x_2.

(b) If $x = -5$, $x_1 = -7$ and $x_2 = 3$, find the value of r.

28. The number of hours H for N workers to paint a wall is given by the formula

$$H = \frac{12}{N}.$$

(a) How many hours does it take for eight workers to paint the wall?

(b) If the wall has to be painted in three hours, how many workers are required?

29. Let $S°$ be the size of an interior angle of a regular polygon. S can be calculated by the formula

$$S = \frac{(n-2)\times 180}{n},$$

where n is the number of sides of the regular polygon.

(a) Find the size of an interior angle of a regular decagon.

(b) Find the number of sides of a regular polygon such that the size of each interior angle is 150°.

30. If n test tubes are produced, the cost price $\$C$ of each test tube can be calculated by the formula

$$C = 16 + \frac{900}{n}.$$

(a) If the cost price of each test tube is \$17.2, find the number of test tubes produced.

(b) If the number of test tubes is decreased from 1000 to 600, find the increase in the cost price of each test tube.

(c) 400 test tubes are produced and sold. If the selling price of each test tube is \$21, find the profit per cent.

(*Give the answers correct to 2 decimal places if necessary.*)

31. The sum S of the squares of all odd numbers from 1 to $2n-1$ is given by the formula

$$S = \frac{n(2n+1)(2n-1)}{3}, \text{ i.e. } S = 1^2 + 3^2 + 5^2 + \ldots + (2n-3)^2 + (2n-1)^2 = \frac{n(2n+1)(2n-1)}{3}.$$

(a) If $n = 6$, find S.

(b) Find $1^2 + 3^2 + 5^2 + \ldots + 21^2 + 23^2$.

(c) Find $13^2 + 15^2 + 17^2 + \ldots + 21^2 + 23^2$.

32. An internet service provider provides wireless internet service for mobile phones. The monthly charge includes the basic fee \$80 and the data usage fee, which is charged at a rate of \$90 per GB.

(a) Let $\$F$ be the monthly charge and d GB be the data usage in that month. Write down the formula for calculating F in terms of d.

(b) Matt pays \$1250 for the service this month, find his data usage by using the formula in **(a)**.

33. In a football tournament, the number of matches N of m participating teams can be calculated by the formula

$$N = \frac{m(m-1)}{2}.$$

(a) How many matches will be played in the tournament if 16 teams participate?

(b) If 21 matches have been played, how many teams participated?

Change the Subject of a Formula

In the formula $A = 3m + x$, the variable A, appearing alone on only one side, is called the ***subject*** of the formula. If we change the subject of this formula to x, then the formula becomes $x = A - 3m$.

Example

Consider the formula $p = 3 + 5r$.
Change the subject of the formula to r.

Solution

$$p = 3 + 5r$$
$$p - 3 = 5r$$
$$r = \frac{p-3}{5}$$

Exercise 3D

1. Consider the formula $A = wl$. Change the subject of the formula to l.

2. Consider the formula $a = \frac{d}{t^2}$. Change the subject of the formula to d.

3. Consider the formula $v^2 = u^2 + 2as$. Change the subject of the formula to s.

4. Consider the formula $z = \frac{1}{x+y}$. Change the subject of the formula to x.

5. Make a the subject of the formula $y = ax^2 - 3$.

6. Make t the subject of the formula $u = v(t + 3)$.

7. Make b the subject of the formula $c = \frac{a+b}{2}$.

8. Make m the subject of the formula $n = -5(m + 3)$.

Make x the subject of each of the following formulas. **(9 – 14)**

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

10. $5(x - 2) = 2(4x + y)$

11. $xy + 6 = 3(2y - x)$

12. $6(x - 4y) = 4(2x - y) - 5$

13. $xy + y = \frac{x-5y}{2}$

14. $\frac{2x+y}{3} = \frac{x-3y}{2}$

15. **(a)** Make a the subject of the formula $c = ab - 4a$.

(b) If $b = 2$ and $c = 17$, find a.

16. **(a)** Make l the subject of the formula $A = \pi r^2 + \pi rl$.

(b) If $A = 27\pi$ and $r = 4.5$, find l.

17. **(a)** Make a the subject of the formula $y = ax + \frac{a}{x}$.

(b) If $x = 7$ and $y = 25$, find a.

18. **(a)** Make a the subject of the formula $5a = 2(a - 3b) + c$.

(b) If $b = -2$ and $c = 7$, find a.

19. **(a)** Make m the subject of the formula $1 - 5(2m + n) = 2(m - 3n)$.

(b) If $n = 8$, find m.

20. **(a)** Make b the subject of the formula $V = \frac{(a + b + ab)h}{3}$.

(b) If $V = 68$, $a = 5$ and $h = 12$, find b.

21. **(a)** Make x the subject of the formula $y = \frac{5}{3}(x - 2)$.

(b) If the value of y is decreased by 1, find the corresponding decrease in the value of x.

22. **(a)** Make x the subject of the formula $3(2x - 3y + 4) = 4x$.

(b) If the value of y is decreased by 1, how will the value of x be changed?

Make y the subject of each of the following formulas. **(23 – 26)**

23. $x = \frac{1 - y}{1 + y}$

24. $x = \frac{x - y}{x + xy}$

25. $3 + y = \frac{x - 2y}{x}$

26. $\frac{2}{3x + y} = \frac{x}{x - y}$

27. **(a)** Make x the subject of the formula $y = \frac{5x + 4}{3x - 1}$.

(b) If $y = 2$, find x.

28. **(a)** Make a the subject of the formula $\frac{b}{a-b} = \frac{3}{5a+b}$.

(b) If $b = -1$, find a.

29. **(a)** Make p the subject of the formula $\frac{q}{p} - \frac{1}{q} = 1$.

(b) If $q = \frac{1}{5}$, find p.

Make x the subject of each of the following formulas. **(30 – 33)**

30. $z = \frac{1}{1+x} - \frac{1}{1+y}$

31. $\frac{xz}{y} + \frac{xy}{z} = \frac{1}{2}$

32. $\frac{2y}{xz} - \frac{3}{xy} = \frac{4}{z}$

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

34. **(a)** Make x the subject of the formula $\frac{1}{2-x} + 2y = z$.

(b) If $y = -5$ and $z = 4$, find x.

35. **(a)** Make y the subject of the formula $x = a^2 - \frac{b}{2y}$.

(b) If $x = 21$, $a = -5$ and $b = 36$, find y.

36. **(a)** Make p the subject of the formula $\frac{m}{p} - \frac{5}{q} = r$.

(b) If $m = 34$, $q = -2$ and $r = \frac{3}{8}$, find p.

37. **(a)** Make b the subject of the formula $\frac{4b}{a} - 2 = \frac{b}{2c}$.

(b) If $a = 9$ and $c = 3$, find b.

38. **(a)** Make a the subject of the formula $\frac{b}{a} = \frac{1}{ab} + \frac{1}{c}$.

(b) If $b = -4$ and $c = \frac{5}{6}$, find a.

39. **(a)** Make x the subject of the formula $y(1+\frac{2}{x}) = z(1-\frac{2}{x})$.

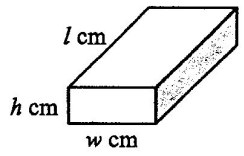
(b) If $y = 3$ and $z = 7$, find x.

40. Let $P\%$ be the profit per cent from the sale of a sofa. P can be calculated by the formula $P = \frac{100(S-C-200)}{C+200}$, where $\$C$ is the cost price of the sofa and $\$S$ is the selling price of the sofa.

(a) Make C the subject of the formula.

(b) The furniture store owner sells a sofa for \$2700 and makes a profit of 25%. Find the cost price of the sofa.

41. The figure shows a rectangular block. Its total surface area A cm^2 is given by the formula $A = 2(lw + hl + hw)$.



(a) Make h the subject of the formula.

(b) If the total surface area of the rectangular block with $l = 8$ and $w = 3$ is 158 cm^2, find h.

42. The air temperature T°C outside an aircraft flying at an altitude of h m is given by the formula

$$T = 25 - \frac{h}{150}.$$

(a) Make h the subject of the formula.

(b) The air temperature outside an aircraft is –5°C. Find the flight altitude of the aircraft.

(c) John claims that when the flight altitude of an aircraft is increased by 150 m, the air temperature outside the aircraft will be decreased by 1°C. Do you agree? Explain your answer.

43. It is given that $y = \frac{1+y}{x-y+y^3-xy^2} - \frac{1}{x-y}$.

(a) Make x the subject of the formula.

(b) If $y = -3$, find x.

Paper II

1. Which of the following is the L.C.M. of $2a$ and $4a$?

   A. $2a$
   B. $4a$
   C. $6a$
   D. $8a$

2. Find the L.C.M. of the expressions $2x$ and $3(x-1)$.

   A. $6(x-1)$
   B. $x(x-1)$
   C. $3x(x-1)$
   D. $6x(x-1)$

3. Simplify $\frac{6r^6}{2r^2}$.

   A. $3r^3$
   B. $3r^4$
   C. $4r^3$
   D. $4r^4$

4. Simplify $\frac{1}{12a}+\frac{1}{3a}$.

   A. $\frac{12a}{5}$
   B. $\frac{5}{12a}$
   C. $\frac{2}{15a}$
   D. $\frac{1}{15a}$

5. Simplify $\frac{1}{z-4}+\frac{1}{4-z}$.

A. 0

B. $\frac{2}{z-4}$

C. $-\frac{2}{z-4}$

D. $-\frac{1}{z-4}$

6. Simplify $\frac{18x^2}{18x^2-12xy}$.

A. $\frac{1}{3x-2y}$

B. $\frac{3x}{3x-2y}$

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

D. $\frac{x}{2x-3y}$

7. Simplify $\frac{3y}{xy-x^2}\div\frac{xy}{3x-3y}$.

A. $-\frac{(x-y)^2}{x^2}$

B. $-\frac{x^2}{(x-y)^2}$

C. $-\frac{1}{9}x^2y$

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

8. Given that $a = b^2 + 5$, find the value of a when $b = -4$.

A. 21
B. 1
C. –3
D. –11

9. Consider the formula $V = \frac{1}{3}\ell^2 h$. When $\ell = 9$ and $h = 4$, $V =$

A. 36.
B. 108.
C. 308.
D. 324.

10. Given that $h = \frac{6-k}{9}$, find the value of k when $h = \frac{1}{2}$.

A. $-\frac{3}{2}$
B. $-\frac{9}{2}$
C. $\frac{3}{2}$
D. $\frac{9}{2}$

11. Consider the formula $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$. When $f = 10$ and $u = 15$, $v =$

A. 30.
B. 25.
C. 20.
D. 5.

12. Make c the subject of the formula $a=\frac{6+c}{3}$.

A. $c=3a-6$
B. $c=3a-2$
C. $c=a-6$
D. $c=a-2$

13. Make x the subject of the formula $2x=5y-3x+5$.

A. $x=y$
B. $x=y+1$
C. $x=5y$
D. $x=5(y+1)$

14. Make q the subject of the formula $\frac{2-q}{4+q}=3r$.

A. $q=\frac{2(1-3r)}{1+3r}$
B. $q=\frac{2(1-6r)}{1+3r}$
C. $q=\frac{2(3r-1)}{1+3r}$
D. $q=\frac{2(6r-1)}{1+3r}$

15. Simplify $\frac{5a^2b}{35a^4b^2}$.

A. $\frac{1}{30a^2b}$
B. $\frac{1}{7a^2b}$
C. $\frac{1}{7a^2b^2}$
D. $\frac{1}{7a^4b^2}$

16. Simplify $\frac{24ac-8bc}{16bc}$.

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

B. $\frac{2a-3b}{b}$

C. $\frac{3a-b}{2b}$

D. $\frac{a-3b}{2b}$

17. Simplify $\frac{7x}{14x^3+21x^2}$.

A. $\frac{1}{2x^2+3x}$

B. $\frac{1}{2x^3+3x^2}$

C. $\frac{1}{7x^2+14x}$

D. $\frac{1}{7x^3+14x^2}$

18. Simplify $\frac{ab-5b}{5c-ac}$.

A. $a-5$

B. $5-a$

C. $\frac{b}{c}$

D. $-\frac{b}{c}$

19. Simplify $\frac{36-x^2}{6-x}$.

A. $x+6$
B. $-x-6$
C. $x-6$
D. $6-x$

20. Simplify $\frac{4n^2}{2m^2} \times \frac{2m}{7n^2}$.

A. $\frac{4}{7m}$
B. $\frac{7m}{4}$
C. $\frac{4}{m}$
D. $\frac{7}{m}$

21. Simplify $\frac{9b^2c^3}{4a} \div \frac{3bc}{2a^3}$.

A. $\frac{3bc^2}{2a^2}$
B. $\frac{3b^2c^3}{2a^3}$
C. $\frac{3a^2bc^2}{2}$
D. $\frac{27b^3c^4}{8a^4}$

22. Simplify $\frac{8c-6d}{3a+3b} \times \frac{a+b}{4c-3d}$.

A. $\frac{2}{3}$

B. $\frac{2}{3(a+b)}$

C. $\frac{2(a+b)}{3}$

D. $\frac{2(c-d)}{3(a+b)}$

23. Simplify $\frac{h^2-4k^2}{10hk^2} \div \frac{2k+h}{25h^3k}$.

A. $\frac{2k(h-2k)}{5h^2}$

B. $\frac{2k(2k-h)}{5h^2}$

C. $\frac{5h^2(h-2k)}{2k}$

D. $\frac{5h^2(2k-h)}{2k}$

24. Simplify $\frac{9b^2}{4a^2} \times \frac{12a^2b}{b^4} \div \frac{ab^2}{15a^3}$.

A. $\frac{5a^2}{9b}$

B. $\frac{9b}{5a^2}$

C. $\frac{b^7}{80a^6}$

D. $\frac{405a^2}{b^3}$

25. Simplify $\frac{8-12b}{a+b} \div (2-3b)^2 \times \frac{a^2-b^2}{2a-2b}$.

A. $\frac{(2-3b)^2}{2}$

B. $2(2-3b)^3$

C. $\frac{2}{2-3b}$

D. $\frac{2(a-b)}{(a+b)(2-3b)}$

26. Simplify $-\frac{1}{2x}+\frac{4}{2x}$.

A. $\frac{3}{2x}$

B. $\frac{3}{4x}$

C. $-\frac{5}{2x}$

D. $-\frac{5}{4x}$

27. Simplify $\frac{2}{10y}+\frac{3}{10y}$.

A. 5

B. $\frac{1}{4y}$

C. $\frac{1}{2y}$

D. $\frac{4}{5y}$

28. Simplify $\frac{7}{a-b}+\frac{5}{b-a}$.

A. $\frac{2}{a-b}$

B. $\frac{2}{b-a}$

C. $\frac{12}{a-b}$

D. $\frac{12}{b-a}$

29. Simplify $\frac{13a}{2a-5}-\frac{5a+20}{2a-5}$.

A. 2

B. 4

C. $\frac{8a+20}{2a-5}$

D. $\frac{18a-20}{2a-5}$

30. Simplify $\frac{5}{k}+\frac{5}{2k}$.

A. $\frac{5}{3k}$

B. $\frac{10}{3k}$

C. $\frac{15}{2k}$

D. $\frac{15}{k}$

31. Simplify $\frac{1}{4y} - \frac{5}{6y}$.

A. $-\frac{2}{y}$

B. $\frac{2}{y}$

C. $-\frac{7}{12y}$

D. $\frac{7}{12y}$

32. Simplify $\frac{3}{2(2+p)} - \frac{1}{2+p}$.

A. $\frac{1}{2(2+p)}$

B. $\frac{1}{2+p}$

C. $\frac{2}{2+p}$

D. $\frac{3}{2+p}$

33. Simplify $\frac{4}{3(6-k)} + \frac{3}{4(6-k)}$.

A. $\frac{1}{6-k}$

B. $\frac{25}{24(6-k)}$

C. $\frac{2}{6-k}$

D. $\frac{25}{12(6-k)}$

34. Simplify $\frac{p}{9(2p-3q)} - \frac{q}{6(2p-3q)}$.

A. $\frac{1}{18}$

B. $\frac{p-q}{18(2p-3q)}$

C. $\frac{p-q}{3(2p-3q)}$

D. $\frac{3p-2q}{18(2p-3q)}$

35. Simplify $\frac{3}{a} - \frac{4}{b}$.

A. $\frac{1}{a-b}$

B. $\frac{1}{b-a}$

C. $\frac{3a-4b}{ab}$

D. $\frac{3b-4a}{ab}$

36. Simplify $\frac{2}{3x} + \frac{2}{x+3}$.

A. $\frac{2}{4x+3}$

B. $\frac{4}{4x+3}$

C. $\frac{4}{3x(x+3)}$

D. $\frac{2(4x+3)}{3x(x+3)}$

37. Simplify $\frac{2}{x+1}-1$.

A. $\frac{1}{x+1}$

B. $\frac{x-1}{x+1}$

C. $\frac{1-x}{x+1}$

D. $\frac{3-x}{x+1}$

38. Simplify $5x+\frac{5x^2}{3x+2}$.

A. $\frac{5x^2+5x}{3x+2}$

B. $\frac{8x^2+2x}{3x+2}$

C. $\frac{20x^2+10x}{3x+2}$

D. $\frac{5x^2+15x+10}{3x+2}$

39. It is given that $x=\frac{3-5y}{3}$. If $y=3$, find the value of x.

A. -4

B. -2

C. $\frac{6}{5}$

D. 6

40. It is given that $x = y^2$. If $y = -1$, find the value of x.

A. -2
B. -1
C. 1
D. 2

41. It is given that $A = 4\pi r$. If $A = 88$ and $\pi = \frac{22}{7}$, find the value of r.

A. $\frac{1}{112}$
B. $\frac{7}{28}$
C. $\frac{16}{7}$
D. 7

42. It is given that $z = \frac{2x - y}{x + 2y}$. If $x = 3$ and $y = 1$, find the value of z.

A. $-\frac{1}{7}$
B. $\frac{5}{7}$
C. 1
D. $\frac{7}{5}$

43. It is given that $2 + \frac{3x}{y} = \frac{z}{2}$. If $x = 2$ and $z = 16$, find the value of y.

A. $\frac{3}{5}$
B. 1
C. $\frac{5}{3}$
D. 36

44. It is given that $y = k(6^n)$. If $k = 3$ and $n = 2$, find the value of y.

A. 36
B. 108
C. 324
D. 432

45. It is given that $s = \frac{a}{1-r}$. If $s = 48$ and $a = 12$, find the value of r.

A. -3
B. $\frac{3}{4}$
C. $\frac{5}{4}$
D. 5

46. It is given that $\frac{1}{u} - \frac{1}{v} = \frac{1}{f}$. If $u = 24$ and $f = 6$, find the value of v.

A. -8
B. $\frac{1}{18}$
C. $\frac{24}{5}$
D. 8

47. It is given that $2a - 7b = ab$. If $a = 3$, find the value of b.

A. $\frac{3}{5}$
B. $\frac{2}{3}$
C. $\frac{3}{2}$
D. $\frac{5}{3}$

48. It is given that $2x+y-\dfrac{8}{x+y}=0$. If $x+y=4$, find the value of x.

A. -6
B. -2
C. 2
D. 6

49. It is given that $x^2-6x+3=0$. Find the value of $2x^2-12x-9$.

A. -15
B. -3
C. 3
D. 15

50. It is given that $1+2+3+\cdots+n=\dfrac{n(n+1)}{2}$. $150+151+152+\cdots+200=$

A. 8 725.
B. 8 775.
C. 8 874.
D. 8 925.

51. Which of the following has a as the subject of the formula?

A. $\dfrac{a}{3}=1-2b$
B. $ab=7$
C. $a=2b^2+3$
D. $a^2=b-5$

52. If $M = \frac{1}{3}\pi r\ell$, then $\ell =$

A. $\frac{1}{3}M\pi r$.

B. $3M\pi r$.

C. $\frac{\pi r}{3M}$.

D. $\frac{3M}{\pi r}$.

53. If $2x - 3y = 6z$, then $y =$

A. $\frac{2x - 2z}{3}$.

B. $\frac{2x - 6z}{3}$.

C. $\frac{6z - 2x}{3}$.

D. $\frac{2x + 6z}{3}$.

54. If $x = 9(y + z)$, then $y =$

A. $9x - z$.

B. $9x + z$.

C. $\frac{x}{9} - z$.

D. $\frac{x}{9} + z$.

55. If $a = b - \frac{1}{c}$, then $c =$

A. $\frac{1}{a-b}$.

B. $\frac{1}{b-a}$.

C. $a-b$.

D. $b-a$.

56. If $T = \frac{p}{2(q+3)}$, then $q =$

A. $\frac{p}{2T} - 3$.

B. $\frac{p}{2T} + 3$.

C. $2T(p+3)$.

D. $2T(p-3)$.

57. If $\frac{3}{x} = \frac{6-2y}{5}$, then $y =$

A. $3 - \frac{15}{2x}$.

B. $\frac{3}{5} - \frac{3}{2x}$.

C. $\frac{15}{6-2x}$.

D. $\frac{6x-15}{x}$.

58. If $m - mn = n$, then $n =$

A. $\frac{m-1}{m}$.

B. $\frac{m+1}{m}$.

C. $\frac{m}{m-1}$.

D. $\frac{m}{m+1}$.

59. If $h = \frac{2k}{k-2}$, then $k =$

A. $\frac{h+2}{2}$.

B. $\frac{h-2}{2}$.

C. $\frac{2h}{h+2}$.

D. $\frac{2h}{h-2}$.

60. If $y = \frac{10+x}{10-x}$, then $x =$

A. $\frac{10(y-1)}{y+1}$.

B. $\frac{10(y+1)}{y-1}$.

C. $\frac{y-1}{10(y+1)}$.

D. $\frac{10+y}{10-y}$.

61. If $a(b+c)-d(b-c)=0$, then $c=$

A. $\frac{a(b-d)}{d+b}$.

B. $\frac{b(d-a)}{a+d}$.

C. $\frac{b(d+a)}{a-d}$.

D. $\frac{d(a-b)}{b+a}$.

62. If $\frac{m+1}{a}=\frac{m-1}{b}$, then $m=$

A. $\frac{a+b}{a-b}$.

B. $\frac{a+b}{b-a}$.

C. $\frac{a-b}{a+b}$.

D. $\frac{b-a}{a+b}$.

63. If $A=20(4-s)$, which of the following must be correct?

I. $s=80-A$

II. $s=\frac{80-A}{20}$

III. $s=4-\frac{A}{20}$

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

64. If $a = \frac{2b-c}{4d}$, which of the following must be correct?

I. $b = \frac{4ad+c}{2}$

II. $c = 2b - 4ad$

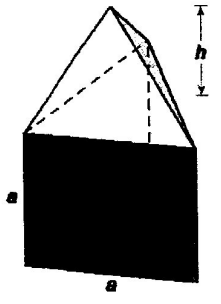
III. $d = \frac{2b-c}{4a}$

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

65. If $y = 1+n$ and $x = \frac{1}{n-1}$, then $y =$

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

66. The figure shows a solid formed by a tetrahedron of height h and a triangular prism with a common base. The volume of the solid is given by the formula $V = \frac{a^2(3a+h)}{12}$, $h =$



A. $\frac{4V}{a^3}$.
B. $12V - 3a^3$.
C. $\frac{12V}{a^2} - 3a$.
D. $\frac{a^2V}{12} - 3a$.