

Non-Calculator Algebra Exercise Book



CfE Level 4 Expressions and Equations (4.14, 4.15)
National 5 Expressions and Formulae

Name _____

A. Simplify:-

1. $5(2x + 6)$	2. $5(3 - 4y)$	3. $2x(6 + x)$	4. $5 - 2(x - 4)$
5. $5a^2b \times 2b$	6. $4x^2y \times 6x$	7. $5y \times 10y$	8. $\frac{4x^2}{2x}$
9. $\frac{y}{5} + \frac{3}{5}$	10. $\frac{y}{4} - \frac{y}{6}$	11. $\frac{3x}{6} + \frac{2x}{7}$	12. $\frac{7}{x} + \frac{x}{7}$

B. Solve :-

13. $3(x + 2) = 15$	14. $4(5 - x) = x$	15. $5(x + 4) = \frac{x + 4}{2}$
16. $4x + 5 > 17$	17. $3(x + 1) < 2(x + 4)$	18. $12 - x > 5x$
19. $x^2 = 36$	20. $2x^2 = 18$	21. $5 + \frac{15}{y} = 3$

A. Simplify:-

1. $2x(2x + 5)$	2. $7(3x - 4y)$	3. $2y(9 - 3x)$	4. $12 - 2(x - 7)$
5. $7a^3b \times 3b$	6. $5x^2y \times 6xy$	7. $5y \times 100y^2$	8. $\frac{9x^5}{6x}$
9. $\frac{y}{7} + \frac{3}{7}$	10. $\frac{y}{6} - \frac{y}{9}$	11. $\frac{3x}{5} + \frac{2x}{8}$	12. $\frac{6}{p} + \frac{y}{7}$

B. Solve :-

13. $3(x - 2) = -12$	14. $7(9 - x) = 2x$	15. $5(x - 3) = \frac{x + 6}{2}$
16. $4x + 5 \leq 17$	17. $3(x - 1) < 2(x - 4)$	18. $21 - 2x > 5x$
19. $x^2 = 144$	20. $2x^2 = 450$	21. $4 - \frac{8}{y} = 8$

A. Expand and simplify:-

1. $2(x - 4) - 7(2x + 5)$	2. $(x + 4)(x + 6)$	3. $(2y+3)(y - 3)$	4. $(3x - 6)(2x - 5)$
5. $9a^5b \times 3b^2$	6. $2x^2y^7 \times 5xy$	7. $(5y)^2$	8. $\frac{12x^9}{8x^4}$
9. $\frac{y}{6} + \frac{3}{9}$	10. $\frac{2x}{4} - \frac{x}{6}$	11. $\frac{3x}{3} + \frac{2x}{7}$	12. $\frac{6}{p} + \frac{p}{7}$

B. Solve :-

13. $3(x - 2) = -1(x + 3)$	14. $7(9 - x) = -2x$	15. $5(x - 1) = \frac{x + 5}{3}$
16. $2(x + 5) \leq 17$	17. $3(1 - x) < 2(x - 4)$	18. $(x + 1)(x + 5) = x(x + 5)$
19. $x^2 = 81$	20. $2x^2 = 8$	21. $3 - \frac{7}{y} = -16$

A. Expand and simplify:-

1. $2(x - 3) - 7(2x + 3)$	2. $(x + 3)(x - 3)$	3. $(3y + 3)(y - 3)$	4. $(3x - 3)(2x - 3)$
5. $9a^6b \times 7b^8$	6. $7x^7y^6 \times 4x^2y$	7. $(7y)^2$	8. $\frac{16x^9}{6x^2}$
9. $\frac{y}{10} + \frac{3}{15}$	10. $\frac{2x}{6} - \frac{x}{8}$	11. $\frac{3x}{5} + \frac{2x}{7}$	12. $\frac{4}{p} + \frac{p}{9}$

B. Solve :-

13. $3(x - 8) = -1(x + 3)$	14. $7(6 - x) = -2x$	15. $4(x - 1) = \frac{x + 5}{3}$
16. $2(x + 9) \leq 17$	17. $3(2 - x) < 2(x - 5)$	18. $2(x + 1)(x + 5) = x(2x + 5)$
19. $x^2 = 49$	20. $2x^2 = 18$	21. $5 - \frac{7}{y} = -16$

A. Expand and simplify:-

1. $2(5x - 3) - 8(2x + 3)$	2. $(x + 0.5)(x - 0.5)$	3. $(4y + 4)(y - 4)$	4. $(3x - 1)(5x - 1)$
5. $10a^8b^2 \times 7b^8$	6. $6x^3y^3 \times 3x^4y^5$	7. $(2y)^3$	8. $\frac{14x^8}{7x^5}$
9. $\frac{y}{12} + \frac{2x}{5}$	10. $\frac{7x}{9} - \frac{x}{6}$	11. $\frac{3x}{7} + \frac{2x}{21}$	12. $\frac{m}{p} + \frac{n}{q}$

B. Solve :-

13. $2(x + 9) \leq -7$	14. $3(2 - x) < 2(5 - x)$	15. $3(x + 1)(x + 5) = x(3x + 5)$
16. $x^2 = 49$	17. $2x^2 = 18$	18. $5 - \frac{7}{y} = -16$

C. Change the subject of each formula to y :-

19. $x = 4y + 5$	20. $3x + 4y = 9$	21. $x = \frac{3ty}{m}$
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A. Expand and simplify:-

1. $4(3x - 3) - 5(4x + 4)$	2. $(x + 0.1)(x - 0.1)$	3. $(5y + 3)(y - 3)$	4. $(6x - 1)(5 - x)$
5. $5a^5b^8 \times 7b^2$	6. $4x^6y^3 \times 8x^4y^2$	7. $(3y)^3$	8. $\frac{18x^9}{9x^4}$
9. $\frac{y}{7} + \frac{2x}{5}$	10. $\frac{7x}{12} - \frac{x}{8}$	11. $\frac{3x}{6} + \frac{2x}{15}$	12. $\frac{a}{c} + \frac{b}{d}$

B. Solve :-

13. $2(x - 9) \leq -7$	14. $5(2 - 3x) < 2(7 - x)$	15. $4(x + 1)(x + 2) = x(4x + 5)$
16. $x^2 = 16$	17. $2x^2 = 72$	18. $5 - \frac{4}{x} = -6$

C. Change the subject of each formula to y :-

19. $2x = 4y + 5$	20. $3x - 4y = 9$	21. $x = \frac{7yp}{w}$
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A. Expand and simplify:-

1. $6(\frac{1}{2}x - 3) - 3(4 - x)$	2. $(x + \sqrt{2})(x - \sqrt{2})$	3. $(7y - 3)^2$	4. $(x + 1)(x + 2)(x + 3)$
5. $\frac{1}{3}a^{12}b^7 \times 6b^2$	6. $2x^2y^3 \times \frac{1}{5}x^4y^5$	7. $2(2y)^3$	8. $\frac{21x^6}{6x^5}$
9. $\frac{p}{6} + \frac{2x}{5}$	10. $\frac{3x}{12} - \frac{3x}{8}$	11. $\frac{3x}{4} + \frac{2x}{6} + \frac{x}{2}$	12. $\frac{1}{4x} + \frac{1}{6y}$

B. Solve :-

13. $2(y - 4) \leq -3(y - 2)$	14. $(x + 3)(x - 4) = 0$	15. $(2x + 5)(x - 1) = 0$
16. $x^2 - 100 = 0$	17. $x^2 + x - 6 = 0$	18. $9 - \frac{3}{x} = -\frac{1}{4}$

C. Change the subject of each formula to y :-

19. $5y + 3 - 2x = 0$	20. $3 - 4y + 9x = 0$	21. $pst = \frac{2t}{y}$
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A. Expand and simplify:-

1. $8(\frac{1}{4}x - 3) - 3(4 - x)$	2. $(x + \sqrt{3})(x - \sqrt{3})$	3. $(5 - 3y)^2$	4. $(x + 2)(x + 3)(x - 4)$
5. $\frac{1}{7}a^8b^9 \times 14b^2$	6. $10x^6y^7 \times \frac{2}{5}x^2y$	7. $3(2y)^4$	8. $\frac{24x^9}{9x^4}$
9. $\frac{p}{4} - \frac{2x}{y}$	10. $\frac{7x}{10} - \frac{3x}{8}$	11. $\frac{3}{(x-2)} + \frac{2}{(x-1)}$	12. $\frac{y-1}{4} + \frac{2}{3}$

B. Solve :-

13. $4(y - 6) \leq -7(y - 1)$	14. $(x+9)(x-1) = 0$	15. $(2x - 7)(3x + 1) = 0$
16. $4x^2 - 36 = 0$	17. $x^2 - 9x + 18 = 0$	18. $2 - \frac{3}{x} = -\frac{1}{5}$

C. Change the subject of each formula to y :-

19. $5 + 3y - 2x = 0$	20. $3 - 4y - 9x = 6$	21. $5xy = \frac{2t}{y}$
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A. Expand and/or Simplify:-

1. $(4x - 5y)^2$	2. $(x + 1)(x + 2)(x + 3)$	3. $\frac{1}{4}a^{-4}b^9 \times 14a^7b^{-2}$	4. $6a^{-\frac{1}{2}} \times 7a^{\frac{3}{2}}$
5. $\frac{y^5 \times y^3}{y^2}$	6. $10x^6y^7 \times \frac{2}{5}x^2y$	7. $3(2y^3)^4$	8. $\frac{14x^{\frac{1}{2}}}{6x^{\frac{1}{4}}}$
9. $\frac{x}{6} + \frac{x}{8}$	10. $\frac{7}{y} - \frac{3}{y}$	11. $\frac{3x}{5} \times \frac{2x}{6}$	12. $\frac{3}{4x} \div \frac{5}{x}$

B. Rationalise the denominator :-

13. $\frac{5}{\sqrt{3}}$	14. $\frac{2\sqrt{5}}{\sqrt{2}}$	15. $\frac{3}{\sqrt{7}+2}$
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C. Solve :

16. $9x^2 - 25 = 0$	17. $x^2 - 6x + 9 = 0$	18. $6x^2 - x - 1 = 0$
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D. Change the subject of each formula to y :-

19. $6 - 2y + x = 0$	20. $\sqrt{2}x = \frac{y}{\sqrt{2}r^2}$	21. $\frac{y}{\pi r^2} = \frac{\theta}{360}$
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A. Expand and/or Simplify:-

1. $(4x - \sqrt{7})^2$	2. $5\sqrt{2} + \sqrt{18} + \sqrt{50}$	3. $\frac{3}{4}a^{-1}b^3 \times 20ab^{-2}$	4. $100a^{-\frac{3}{5}} \times 0.7a^{-\frac{3}{5}}$
5. $\frac{y^{-2} \times y^3}{y^7}$	6. $15x^6y^7 \times \frac{2}{5}x^{-4}$	7. $(3y^7)^3$	8. $\frac{x^{\frac{2}{3}}}{x^{\frac{1}{5}}}$
9. $\frac{m}{6} + \frac{5m}{6}$	10. $\frac{4}{y} - \frac{9}{y}$	11. $\frac{8}{5x} \times \frac{2x}{6}$	12. $\frac{3}{4x} \div \frac{x}{6}$

B. Evaluate :-

13. 4^{-2}	14. $27^{\frac{1}{3}}$	15. $25^{\frac{3}{2}}$
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C. Solve :

16. $4x^2 - 6x = 0$	17. $x^2 - 6x = -9$	18. $6 - x - x^2 = 0$
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D. Change the subject of each formula to y :-

19. $x = 15 - 3y$	20. $5x = \frac{2y}{r^2}$	21. $x = \pi r^2 y - 10$
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A. Expand and/or Simplify:-

1. $(3x - \sqrt{7})(2x + \sqrt{7})$	2. $(4 - 3x)(2x - 1)$	3. $(2x - 1)^3$	4. $5x^3 \times 4x^{-5}$
5. $\frac{6y^5}{9y^2}$	6. $3x^{-\frac{2}{5}} \times 4x^{-\frac{1}{5}}$	7. $(5y^{\frac{1}{5}})^3$	8. $3a^{-2}b^3 \times \frac{1}{4}a^7b^8$
9. $\frac{3m}{y} + \frac{5}{y}$	10. $\frac{5x}{7} - \frac{7y}{3}$	11. $\frac{3}{2x} \times \frac{5}{7x}$	12. $\frac{5}{8x} \div \frac{15}{4x^2}$

B. Evaluate :-

13. 2^{-5}	14. $125^{-\frac{1}{3}}$	15. $16^{\frac{3}{2}}$
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C. Solve :

16. $8x - 20x^2 = 0$	17. $x^2 + 2x = 15$	18. $10x^2 - x - 2 = 0$
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D. Change the subject of each formula to y :-

19. $5x = 15 - 10y$	20. $7r = \frac{2y}{r^2}$	21. $x + 1 = \pi r^2 y - 10$
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A. Expand and/or Simplify:-

1. $(7y - \sqrt{3})(7y + \sqrt{3})$	2. $8(3 - 2x)^2$	3. $(3x^5)^2$	4. $9x^{11} \times 4x^{-3}$
5. $\frac{12y^5}{9y^8}$	6. $6x^{-\frac{2}{7}} \times 4x^{-\frac{3}{7}}$	7. $(3y^{\frac{1}{2}})^4$	8. $3a^{-2}b^3 \times \frac{1}{9}a^7b^{-7}$
9. $\frac{3}{m} + \frac{5}{2m}$	10. $\frac{2(x+1)}{4} - \frac{3x}{3}$	11. $\frac{7}{10x} \times \frac{5y}{7x}$	12. $\frac{6}{7x} \div \frac{9}{14x^3}$

B. Evaluate :-

13. 2^{-5}	14. $125^{-\frac{2}{3}}$	15. $4^{\frac{3}{2}}$
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C. Solve :

16. $5x - 20x^2 = 0$	17. $x^2 = 5x + 24$	18. $6x^2 - 7x - 3 = 0$
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D. Change the subject of each formula to y :-

19. $6x = 6 - 6y$	20. $7r = \frac{2}{yr^2}$	21. $2x - 1 = \pi r^2 y - 10$
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A. Expand and/or Simplify:-

1. $(y - \sqrt{7})(y + \sqrt{7})$	2. $3(4 - 2x)^2$	3. $(2y^5)^4$	4. $8x^{11} \times 8x^{-3}$
5. $\frac{15y^7}{9y^{-2}}$	6. $6x^{-\frac{2}{7}} \times 8x^{-\frac{5}{7}}$	7. $(2y^{\frac{1}{3}})^5$	8. $10a^{-2}b^3 \times \frac{1}{5}a^{-1}b^{-7}$
9. $\frac{2}{3y} + \frac{5}{7y}$	10. $\frac{2(3-x)}{5} - \frac{3x}{3}$	11. $\frac{7x}{10} \times \frac{5x}{7y}$	12. $\frac{6x^2}{7} \div \frac{15}{14x^3}$

B. Evaluate :-

13. 10^{-4}	14. $25^{-\frac{3}{2}}$	15. $9^{\frac{1}{2}}$
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C. Solve :

16. $12x^2 - 28x = 0$	17. $x^2 = 7x - 12$	18. $2x^2 - 5x - 12 = 0$
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D. Change the subject of each formula to y :-

19. $24x = 12 - 6y^2$	20. $\frac{6r}{5} = \frac{2}{yr^2}$	21. $a = \frac{y}{360} \pi r^2$
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A. Expand and/or Simplify:-

1. $(y - \sqrt{6})(y - \sqrt{6})$	2. $3(4 - x)^2$	3. $(2y^5)^{-3}$	4. $5x^{-4} \times 8x^{-3}$
5. $\frac{15y^{-3}}{21y^{-2}}$	6. $90x^{-\frac{4}{7}} \times 2x^{-\frac{3}{7}}$	7. $(2y^{\frac{1}{5}})^3$	8. $21a^{-2}b^{-3} \times \frac{1}{7}a^{-3}b^7$
9. $\frac{7}{3y} + \frac{5}{y}$	10. $\frac{3(9-x)}{5} - \frac{5x}{3}$	11. $\frac{7x}{15} \times \frac{5x}{21y}$	12. $\frac{9x^2}{21} \div \frac{15}{14x^7}$

B. Evaluate :-

13. $100^{-\frac{1}{2}}$	14. $27^{-\frac{2}{3}}$	15. $16^{\frac{1}{2}}$
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C. Solve :

16. $2x^2 - 18 = 0$	17. $x^2 = 11x - 18$	18. $2x^2 + x - 6 = 0$
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D. Change the subject of each formula to y :-

19. $4x = 7 - 2y^2$	20. $\frac{6r}{5} = 1 + \frac{2}{y}$	21. $a = \frac{y}{360} 2\pi r$
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A. Expand and/or Simplify:-

1. $(y - 3)(y - 3x + 1)$	2. $-2(9 - x)^2$	3. $(2x^2y^5)^{-3}$	4. $4x^{-9} \times 7x^8$
5. $\frac{18y^{-3}}{21y^{-4}}$	6. $19x^{-\frac{4}{7}} \times 2x^{-\frac{2}{7}}$	7. $(2y^{\frac{1}{4}})^4$	8. $21a^{-2}b^{-6} \times \frac{1}{6}a^{-5}b^8$
9. $\frac{4}{y-1} + \frac{5}{y-2}$	10. $\frac{2}{y} - \frac{6}{y(y+3)}$	11. $\frac{9x^7}{14} \times \frac{7x^{-3}}{27x^5}$	12. $\frac{9x^2y^{-2}}{21} \div \frac{15y^4}{7x^7}$

B. Evaluate :-

13. $81^{-\frac{1}{2}}$	14. $27^{-\frac{1}{3}}$	15. 9^{-1}
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C. Solve :

16. $3x^2 - 75 = 0$	17. $x^2 - 2x = -1$	18. $2x^2 - 3x - 35 = 0$
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D. Change the subject of each formula to x :-

19. $y - b = m(x - a)$	20. $\frac{5}{\sin y} = \frac{150}{x}$	21. $V = \frac{4}{3}\pi x^3$
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A. Expand and/or Simplify:-

1. $(y - 3)(1 - 3y + y^2)$	2. $12 - (3 - x)^2$	3. $(2x^4)^{-3}$	4. $8x^{-20} \times 7x^8$
5. $\frac{7y^{-3}}{21y^{-2}}$	6. $x^{-\frac{5}{6}} \times 7x^{-\frac{1}{6}}$	7. $(8y^{\frac{1}{4}})^{\frac{1}{3}}$	8. $9a^{-6}b^6 \times \frac{1}{12}a^5b^{-8}$
9. $\frac{1}{y-2} - \frac{1}{y}$	10. $\frac{2}{(y+3)} + \frac{6}{y(y+3)}$	11. $\frac{9x^8}{7} \times \frac{7x^{-3}}{6x^5}$	12. $\frac{x^2}{y^3} \div \frac{y^4}{x^7}$

B. Evaluate :-

13. $121^{-\frac{1}{2}}$	14. $125^{\frac{1}{3}}$	15. $(\sqrt{3})^{-2}$
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C. Solve :

16. $9x^2 - 64 = 0$	17. $x^2 + 20 = 9x$	18. $3x^2 + x - 4 = 0$
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D. Change the subject of each formula to x :-

19. $y - b = \frac{1}{2}(x - a)$	20. $\frac{5}{\pi y} = \frac{70}{x}$	21. $V = \frac{1}{3}\pi x^2 h$
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