2021-2022

TCOLC Sixth Form

Yr11 – 12 Transition Activities

Subject: Maths

BUSINESS & ENTERPRISE
The City of Leicester College

Introduction

This booklet is designed to help students to equip themselves with the algebra skills necessary for AS/A level Maths courses.

If you are planning to study Mathematics at AS/A level, you should attempt to work through the whole booklet.

Some of you will already have good algebraic skills. For this reason, many sections have a diagnostic test which will allow you to check if you need help and/or more practice on an aspect of algebra. If you can already do the type of questions in the test you can move on although doing at least some of each exercise will do you no harm at all!

If you are intending to study AS/A level Maths, by the time you begin the course you must be able to do the questions in this booklet with no difficulty at all. You must take responsibility for improving your own algebraic skills.

This booklet will help you to identify problem areas but you must check your answers honestly and seek additional help where necessary. **You will be given details of further online resources to use if you require help when working on your own.** You must attempt all of the appropriate exercises for further practice. If you work hard; using this booklet and any other relevant (e.g. online) materials and get help from your teacher where necessary, you will acquire the algebraic skills necessary to succeed in AS/A level Maths.

You can also find some tutorial videos on the following link:

http://m4ths.com/gcse-to-a-level-bridge.html

Contents

1. Evaluating Expressions

Diagnostic

Using the values $p = 2$, $q = -1$, $r = 3$, find the value of each of the following

A) pqr

B) $\frac{3p - 2q}{4r}$

C) $4 - 2p - q$

D) $3p^2 - 5q^2$

E) $\square(r^2 + 4p^2)$

Check your answers in the *Answers to diagnostic tests*

If you have got any of the above incorrect, work on some questions from Exercise 1.

If you got all 5 questions correct, you may still find it useful to do the more difficult questions in Exercise 1 to consolidate your substitution and evaluation skills.

Exercise 1

1. If $a = 2$, $b = -1$, $c = 4$ find the values of the following

   a) $3a + 2$
   b) $b - 3$
   c) $5b$
   d) $8c - 3$
   e) $2abc$
   f) $3b + 2$
   g) $\frac{c}{4}$
   h) $a + 3b - c$
   i) $8a - 2b + 5c$
   j) $a - b - c$
   k) $2b - c - 2a$
   l) $\frac{3ac}{b}$

2. If $p = 4$, $q = 3$ and $r = -2$ find the values of the following

   a) $2pq - r$
   b) $\frac{p}{2} - q + \frac{r}{2}$
   c) $\frac{5p}{q - r}$
   d) $\frac{3pq}{p - r}$
   e) $\frac{4r + 3q}{r + q}$
   f) $\frac{qr - p}{q - r}$

3. If $x = 3$, $y = -3$, $z = -1$, find the values of the following

   a) $x^2 + y^2 + z^2$
   b) $2x^2 - y^2 + 2z^2$
   c) $\sqrt{4x^2 + y^2}$
   d) $(2y)^2 - 2y^2$
   e) $\sqrt[3]{3(x^3 - z^3)}$

2. Simplifying expressions

Diagnostic

Simplify the following

A) $4x - 2y + 3x + 8y - 2z$

B) $2a - 3a^2 + 5a + 5 + 7a^2$

C) $5a \times 7a$

D) $\frac{4x5_3}{2x}$

E) $2(a + 3b) + 4(a - b)$

F) $(-4a) \div (-2a)$

G) $4t \times (-5t)$

H) $(-7xy) \times (-3x^2y)$

I) $(-r) \times (-2r) \times (-r)$

J) $(4z + 8y) \div \frac{y}{2}$

Check your answers in the *Answers to diagnostic tests*

If you got any of A - E incorrect, do Exercise 2A below.

If you got any of F - J incorrect, do Exercise 2B below.

Exercise 2A

Simplify these expressions

1. $5x + 2x - 7x$
2. $5y - 2y - 9y$
3. $2q - 7p + 4p + 5q$
4. $8a - 2b + 7a + 6b$
5. $3ab - 2ab + 9ab$
6. $t \times 5t$
7. $h \times 4h \times 3h$
8. $w \times w \times 3w$

$4d \div 2d$

10. $20p^3 \div 5p^2$
11. $p^3 \times p^5$
12. $35d^5 \div 7d^4$

13. $6c \times 5c$

14. $6y \times 8y^2$
15. $(9t)^2$
16. $(3r)^3$
17. $\square(49t^2)$
18. $\sqrt[3]{\square}(27b^6)$
19. $qp + 2qp - r$
20. $h + 4h^2 - 2h + 7h^2$
21. $pq + qp$
22. $a^3 - 5a^3 - 7a^3$
23. $3(2a + 3b) + 2(a - 5b)$

9.

24. $7(x^2 - 2x + 21)$
25. $5(d - 2) - (d - 5)$
26. $4(w - 3) + 7(2w - 3)$
27. $8pq \div 4qr$
28. $(2ab^2)^2$
29. $(3xy)^3$
30. $(ab)^2 \times (ab^2)^3$

Exercise 2B

Simplify these expressions

1. $p \times -q$
11. $(t/2) \div (t/3)$

2. p x $(-p)$
3. $4t$ x $(-5t)$
4. $27y^3 \div (-3y)$
5. $4a^2b^3$ x $2ab^2$
6. $(-7xy)$ x $(-3x^2y)$
7. p x $3p$
8. $(-6p)$ x $(3p)$
9. $(t/2)$ x $(t/3)$
12. $(t^3/4)$ x $(t^2/3)$
13. $(t^3/4) \div (t^2/3)$
14. $2ab^2$ x $(-3b^2)$
15. $(w - 2p) - (3p - 4w)$
16. $(-r)$ x $(-2r)$ x $(-r)$
17. (y^2) x $(-2y)$ x $(-3y)$
18. $-3(x - 2y) - 4(3y - 5x)$
19. $(4z + 8y)$ x $(y/2)$

3. Removing Brackets (1 bracket)

Diagnostic

Remove the brackets in each of the following

A) $4(x + 3)$

B) $-3(x + 2)$

C) $3(4x + 7y)$

D) $2(3a - 5)$

E) $-4(2x - 3)$

F) $2a^2(3a - 2b)$

G) $-3a(5a + b - 2c)$

Check your answers in the *Answers to diagnostic tests*

If you got any of these incorrect, attempt Exercise 3 below.

Exercise 3

Remove the brackets in each of the following

1. $6(x + 7)$
2. $3(x - 5)$
3. $-2(a + 2b)$
4. $4(3x - 2y)$
5. $-(y - 3x)$
11. $a(a + 2b - c)$
12. $p(3p - 2q - 4r)$
13. $8(x - 4y)$
14. $-3x(x^2 - 2)$
15. $3a(a^2 - b^2)$

6. $8x(x + 5)$
7. $p(3- 2p)$
8. $3w(4x + 5w)$
9. $3k(3k + 1)$
10. $-9a^2(a – 3)$
16. $y(x – y – 3)$
17. $2x(4x + 5y – 3z + 5)$
18. $-5c^2(3 – 4c)$
19. $9y(1 – y^2)$
20. $-5d(2 – 3d)$

4. Removing Brackets (2 brackets)

Diagnostic

Remove the brackets in each of the following

A) $(x + 4)(x + 3)$

B) $(x + 5)(x – 1)$

C) $(2x + 3)(x – 2)$

D) $(2x – 1)^2$

Check your answers in the *Answers to diagnostic tests*

If you got any of these incorrect, attempt Exercise 4 below.

Exercise 4

Remove the brackets in each of the following

1. $(x + 3)(x + 2)$
2. $(x - 5)(x + 4)$
3. $(x + 3)(x – 5)$
4. $(x – 2)(x – 7)$
5. $(2x + 1)(x + 3)$
11. $(x – y)(x + 2y)$
12. $(3- 2p)(2 – 3p)$
13. $(x – 4y)(y – 2x)$
14. $(x^2 – 2)(x + 1)$
15. $(a – b)(a + b)$

6. $(a + 2b)(a – b)$
7. $(3x - 4)(2x – 1)$
8. $(x + 3)^2$
9. $(3k + 1)^2$
10. $(a – 3)^2$
16. $(a + b)(a + b)$
17. $(3a + 1)(3a – 1)$
18. $(3a + 1)(3a + 1)$
19. $(y + 2)(1 – y^2)$
20. $(4d + 3)(2 – 3d)$

5.Factorising (one bracket)

Diagnostic

Factorise the following

A) $3x + 18$

B) $25x – 30y$

C) $ab + 2b$

D) $5p + 15p^2$

E) $cd^2 - 3cd^3$

Check your answers in the *Answers to diagnostic tests*

If you got any of these incorrect, attempt Exercise 5 below.

Exercise 5

Factorise the following

1. $3x + 9$
2. $4x - 4$
3. $49x – 21y$
4. $pq - pr$
11. $hc^2 – 3h^3c$
12. $pq – 5qp^2$
13. $4ab^2c^3 – 6a^2bc^3$
14. $(x/2) +(y/4) + (z/8)$

5. $bx^2 + bx$
6. $3x^2 - 2x$
7. $ab^2 + 4a^2b$
8. $2\pi r^2 + \pi rh$
9. $45a^2 - 63ab^2$
10. $x^3 + 2x^2$
15. $18c^2 - 6c + 36c^3$
16. $5x^2 - 30x$
17. $7y^4 + 3y^3$
18. $5t^2r^3 + 10t^2r^3$
19. $\square x + 5y\square x$
20. $\square x + 4x$

6.Factorising (two brackets)

Diagnostic

Factorise

A) $x^2 + 8x + 7$

B) $x^2 + 2x - 8$

C) $x^2 - 6x + 9$

D) $x^2 - 36$

E) $x^2 - 36y^2$

F) $3x^2 - 5x - 2$

G) $12 + x - x^2$

H) $50 - 2x^2$

Check your answers in the *Answers to diagnostic tests*

If you got any of these incorrect, attempt Exercise 6 below.

Exercise 6

Factorise the following

1. $x^2 + 6x + 8$
2. $x^2 - 3x + 2$
9. $x^2 - 49$
10. $15q^2 - 26q - 21$

3. $x^2 + 2x - 15$

4. $x^2 - 5x - 14$

5. $x^2 + 9x + 20$

6. $2x^2 - 9x - 5$

7. $2x^2 + 13x + 15$

8. $2x^2 - 5x + 3$

11. $35 - x - 6x^2$

12. $28 - 3x - x^2$

13. $x^2 - 18x + 81$

14. $16a^2 - 25b^2$

15. $p^2 - 2pq + q^2$

16. $100 - 36x^2$

7.Linear Equations

Diagnostic

Solve the following equations

A) $5x - 14 = 24$

B) $4x - 5 = 17 - 7x$

C) $6(2x - 1) = 5(4x - 6)$

D) $\frac{2}{7}^{x-5} = 5$

E) $\frac{4}{x-2} = \frac{7}{2x-3}$

Check your answers in the *Answers to diagnostic tests*

If you got any of these incorrect, attempt Exercise 7A and 7B below.

Exercise 7A

Solve each equation

1. $x + 7 = 19$

2. $3p - 8 = 13$

3. $7x = 42$

9. $5(9 - 2w) = 3w$

10. $5(d + 2) - 3(d - 5) = 29$

11. $0.6x = 5.4$

4. $14 - 3x = 8$

5. $9x - 3x + 5x = 33$

6. $6t - 7 = 23$

7. $3(x - 7) = 12$

8. $2k + 5 = 7k - 15$

12. $2.7x - 4.1 = 8.4 - 2.3x$

13. $\frac{5x - 7}{3} = 8$

14. $5 - 9f = 3f + 29$

15. $8(7 - 2x) = 4x + 3$

16. $\frac{3}{x - 2} = \frac{4}{x + 4}$

Exercise 7B

Solve each equation

1. $\frac{5}{x-5} = \frac{8}{2x-1}$
2. $\frac{x+3}{4} - \frac{x-3}{5} = 2$
3. $\frac{x-2}{} = 5 \quad x-3$
4. $\frac{3q-5}{4} - \frac{9-2q}{3} = 0$
5. $\frac{3w-5}{2} = \frac{6-3w}{3}$
6. $\frac{2-t}{5} = \frac{t}{3}$
7. $\frac{3x-1}{2} - \frac{2x-1}{3} = \frac{1-2x}{4}$
8. $\frac{3}{2(x-4)} = \frac{5}{3(x-2)}$

8. Quadratic equations

Diagnostic

Solve the following quadratic equations

A) $(x + 4)(x + 3) = 0$

B) $(x + 5)(x – 1) = 0$

C) $(2x + 3)(x – 2) = 0$

D) $x^2 + 2x – 3 = 0$

E) $x^2 – 4x = 0$

F) $3x^2 – 5x – 2 = 0$

G) $x^2 – 4x – 11 = 0$

H) $3x^2 + 7x – 5 = 0$

Check your answers in the *Answers to diagnostic tests*

If you got any of A - D incorrect, do Exercise 8A below.

If you got any of E - H incorrect, do Exercise 8B below.

Exercise 8A

Solve the following quadratic equations using factorisation

1. $x^2 + 4x – 32 = 0$
2. $x^2 + 9x + 20 = 0$
3. $x^2 – 25 = 0$
4. $7x^2 – 63 = 0$
5. $(x – 2)(x – 7) = 0$
6. $x(x – 6) = 0$
7. $2x(5 – x) = 0$
8. $(2x + 1)(x + 3) = 0$
9. $(2 – x)(3 + 2x) = 0$
10. $x^2 + x – 72 = 0$
11. $x^2 + 5x = 0$
12. $14y^2 = 29y - 12$
13. $4x^2 - 4x - 3 = 0$
14. $y^2 = 10y - 25$
15. $9x + 28 = 9x^2$
16. $5x^2 – 80 = 0$
17. $x^2 - 8x – 33 = 0$
18. $4 - x – 5x^2 = 0$
19. $p(5 – p) = 0$
20. $t(4 + 7t) = 0$

Exercise 8B

Solve the following quadratic equations using the quadratic formula

1. $x^2 - 3x – 1 = 0$
2. $3x^2 - 4x - 1 = 0$
6. $x^2 + 5x = 11$
7. $(2x – 3)^2 = 8$

3. $5x^2 - 3x - 5 = 0$

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

5. $x(x - 7) = 13$

8. $4x^2 + 2x - 3 = 0$

9. $y^2 + 5y - 3 = 0$

10. $\frac{5}{x - 3} - \frac{1}{x} = 3$

9. Simultaneous equations

Diagnostic

Solve the following pairs of simultaneous equations

A) $3x + 4y = 11$
$4x - 2y = 2$

B) $7x + 4y = 41$
$x + 7y = 15$

C) $x - 6y - 5 = 0$
$xy - 6 = 0$

Check your answers in the *Answers to diagnostic tests*

If you got A/B incorrect, do Exercise 9A below.

If you got C incorrect, do Exercise 9B below.

Exercise 9A

Solve the following pairs of simultaneous equations

1. $x - y = 6$ $\quad\quad$ $x + 3y = 7$

2. $x + 3y = 11$
   $5x - 2y = 4$

3. $3x + 2y = 13$
   $8x - 7y = 10$

4. $8x - 12y + 5 = 0$
   $28x - 20y + 1 = 0$

5. $2x - 2y = 12 \quad x + 5y = 0$

6. $3(2 - x) + 2(3 + y) = 11$
   $4(x - 2) + 3(y - 1) = 13$

7. $x - 8y + 20 = 0$
   $9x + y = 39$

8. $x + y = 3$
   $3x + 2y = 7$

Exercise 9B

1. $x + 2y = 5$
   $xy = 2$

2. $x - y = 2$
   $x^2 + 3y = 4$

3. $y = 3x - 8$
   $2x^2 - y^2 = 4$

4. $x + 2y + 5 = 0 \qquad x^2 - x + y =$
   0

5. $x + y = 6$
   $(x - 2)^2 + y = 10$

6. $2y + x = 10$
   $2x^2 + 3y^2 = 7xy$

10. Change the subject of the formula

Diagnostic

In each case make the letter in brackets the subject of the formula

A) $y = rx + p$ (x)

B) $h = abc$ (b)

C) $f = \frac{g}{h}$ (h)

D) $y = \frac{s}{t}(ax - b)$ (x)

E) $T = \frac{3W}{P - Q}$ (Q)

F) $h = \sqrt{(g - 2p)}$ (g)

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

Check your answers in the *Answers to diagnostic tests*

If you got any of these incorrect, attempt Exercise 10 below.

Exercise 10

In each case make the letter in brackets the subject of the formula

1. $p = aq - r$ (q)
2. $k = 2mn$ (m)
3. $d = \frac{5e}{t}$ (t)
4. $F = \frac{srV}{r}$ (r)

G

		(T)
5.	$P = 5T^2Q$	(x)
6.	$y = 5t(x - 3)$	(t)
7.	$y = 5t(x - 3)$	(x)
8.	$B = \frac{3d^2x}{C}$	(C)
9.	$B = \frac{3d^2x}{C}$	(x)
		(t)
10.	$y = h - 0.2x$	(B)
11.	$R = x(3 - pt)$	(R)
12.	$A = \frac{5(R - t)}{B}$	(t)
13.	$A = \frac{5(R - t)}{B}$	(d)
14.	$A = \frac{5(R - t)}{B}$	(x)
15.	$h = \frac{d}{3} + w$	(h)
16.	$w = y - cx$	(b)
17.	$A = 2\pi r^2 + 2\pi rh$	(V)
18.	$V = abc$	(s)
19.	$P = TV^2$	(t)
20.	$a = 5(s^2 - r)$	(a)
21.	$u = \frac{t + 2}{}$	(t)

$$t \text{ - } 2$$

22. $b = \dfrac{a - 5}{3 \text{ - } a}$

23. $h = \dfrac{(t - 2)}{P \text{ - } rt}$

11. Indices

It is recommended that you attempt all questions in Exercise 11 below.

Exercise 11

Simplify each of the following

1. g_3h_2

g^2h^5

2. $\frac{3k^4m^7}{9km^2}$

3. $8n^5p^2 \quad 6n^7p$

4. $q^{-2}r^3 \quad qr^4$

5. $(b^{-2})^3$

6. $(c^3)^{-2}$

7. $(2d^3)^4$

8. $(e^{-3})^{-2}$

9. $(ab^2c)^3$

10. $\left(\frac{2p^3}{4pq}\right)^2$

11. $\frac{3r^{-2}}{9r^{-1}}$

12. $\left(\frac{3r^{-2}}{9r}\right)^{-2}$

13. $(2a^3b^{-3}c^2)^{-1}$

$(4a^{-2}b^2c^{-1})^2$

12. Surds

It is recommended that you attempt all questions in Exercises 12A, 12B and 12C below. (Do not use a calculator)

Exercise 12A

Simplify the surds

1) $\sqrt{60}$
2) $\sqrt{72}$
3) $\sqrt{18}$
4) $\sqrt{245}$
5) $\sqrt{48}$
6) $\sqrt[3]{48}$
7) $\sqrt[3]{500}$
8) $\sqrt[4]{162}$

Exercise 12B

Expand and simplify

1) $\sqrt{3}(2 + \sqrt{7})$
2) $\sqrt{5}(1 - \sqrt{2})$
3) $(\sqrt{2} + 1)(3 + \sqrt{2})$
4) $(\sqrt{3} + 2)(\sqrt{3} - 1)$
5) $(\sqrt{2} - 2)(\sqrt{3} + 5)$
6) $(\sqrt{2} + 4)(\sqrt{3} - 2)$
7) $(\sqrt{3} + \sqrt{2})(\sqrt{3} - 2\sqrt{2})$
8) $(3\sqrt{2} - 4)(2\sqrt{2} - 2)$
9) $(\sqrt{5} + 1)(2\sqrt{3} - 3)$
10) $(\sqrt{2} + 7)(\sqrt{2} - 7)$

Exercise 12C

Rewrite the following expressions with rational denominators

1. $\frac{1}{\sqrt{2}}$

2. $\frac{3}{\sqrt{5}}$

3. $\frac{\sqrt{2}}{\sqrt{7}}$

13. Inequalities

It is recommended that you attempt all questions in Exercise 13.

Exercise 13

Solve the following inequalities

1. $x + 3 < 9$
2. $2x - 1 > 7$
3. $4x \leq 32$
4. $3x + 2 \geq x - 6$
5. $2(x - 5) > 3x - 7$
6. $4 - 2x < x + 1$
7. $-2x + 3 > 9$
8. $7 - 8x \leq 1 - 2x$
9. $2 + 3(x - 7) > 3 - 4(2x + 9)$
10. $5 - 3(2x - 1) \geq 4(1 - 3x) - 2$