English Version

S1 Summer Exercise – Simple Equation

Removing brackets 撤去括號:

Consider the equation $3(x+1)=2x-7$.

$$3(x+1)=2x-7$$
$$3x+3=2x-7$$
$$3x-2x=-7-3$$
$$x=-10$$

Remove the bracket: $3(x+1)$

The solution of the equation $3(x+1)=2x-7$ is -10.

Eliminating Denominators 消去分母:

For equations with denominators, we may ***multiply both sides*** of an equation ***by the same value*** to eliminate the denominators.

Consider the equation $\frac{y}{3}+\frac{y}{4}=7$.

$$\frac{y}{3}+\frac{y}{4}=7$$
$$\left(\frac{y}{3}+\frac{y}{4}\right)\times 12=7\times 12$$

The L.C.M. of 3 and 4 is 12.

$$\frac{y}{3}\times 12+\frac{y}{4}\times 12=84$$
$$4y+3y=84$$
$$7y=84$$
$$y=\frac{84}{7}$$
$$=12$$

The solution of the equation $\frac{y}{3}+\frac{y}{4}=7$ is 12.

Quick Review:

Addition 加法	Sum 和
Subtraction 減法	Difference 差

Multiplication 乘法	Product 積
Division 除法	Quotient 商

Algebraic Equations in One Unknown

Level 1

Solve the following equations. **(1 – 6)**

1. $x - 4 = -7$

2. $2 - y = 10$

3. $8p = 64$

4. $-6q = -72$

5. $\frac{a}{5} = 3$

6. $\frac{2b}{9} = -1$

Solve the following equations. **(7 – 12)**

7. $2x + 1 = 7$

8. $5h - 2 = 18$

9. $6 = 8y + 14$

10. $10 - 3k = -5$

11. $4z + 3 = 5$

12. $3 - 12n = 4$

Solve the following equations. **(13 – 16)**

13. $\frac{r+1}{2} = 5$

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

15. $\frac{1}{7}(c-2) = -1$

16. $\frac{40-d}{6} = 5$

Solve the following equations. **(17 – 20)**

17. $2(a+1) = 18$

18. $5(b-2) = 20$

19. $3(p+9) = -15$

20. $-7(10-q) = 21$

Solve the following equations. **(21 – 24)**

21. $\frac{w}{3} + 1 = 10$

22. $\frac{y}{2} - 5 = 6$

23. $4 + \frac{r}{5} = -12$

24. $7 - \frac{m}{4} = 3$

Level 2

Solve the following equations. **(25 – 28)**

25. $3a + \frac{2}{5} = 1$

26. $\frac{1}{2} - \frac{b}{3} = 2$

27. $3 = -7x - 1.2$

28. $1 - 0.7y = -6$

Solve the following equations. **(29 – 34)**

29. $\frac{3y + 7}{5} = 2$

30. $-2 = \frac{4 - 2m}{9}$

31. $4(2p + 1) = -12$

32. $3(5b - 2) = -6$

33. $\frac{4s}{7} + 1 = 5$

34. $1 - \frac{2t}{5} = -4$

Solve the following equations. **(35 – 38)**

35. $\frac{y + 2}{3} - 4 = 6$

36. $\frac{2(q - 3)}{5} = 4$

37. $-4 + \frac{6 - 3d}{2} = 8$

38. $\frac{2}{5}(7 - 2z) = -10$

Level 1

Solve the following equations. **(1 – 10)**

1. $3x + x = 4$

2. $2y + 5y = 14$

3. $7p - 4p = 6$

4. $5q - 9q = 16$

5. $8c = 4c - 20$

6. $9 - 4d = 2d$

7. $4 + 6a + a = -10$

8. $1 - b - 7b = 9$

9. $r - 1 = 3r + 3$

10. $-3 + 5s = 6 - 4s$

Solve the following equations. **(11 – 18)**

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

12. $4(z - 1) = 3z$

13. $-(10 - 4k) = 6k$

14. $6(5 + 2s) = -3s$

15. $5b = 2(3 - 2b)$

16. $7 = -2(3t - 5)$

17. $3(1 + x) = 7x - 9$

18. $4(2d - 1) = d + 3$

Solve the following equations. **(19 – 24)**

19. $p + \frac{p}{2} = 3$

20. $\frac{q}{4} + \frac{q}{3} = 7$

21. $2t - \frac{t}{6} = -11$

22. $\frac{h}{3} - \frac{3h}{5} = -4$

23. $\frac{w}{8} = \frac{1}{2} + \frac{w}{4}$

24. $1 - \frac{r}{7} = \frac{2r}{3}$

Level 2

Solve the following equations. **(25 – 32)**

25. $x - 3x + 3 = 4x + 15$

26. $7 - 4m + 3m = m + 1$

27. $4y = 3(7 - 2y) - 1$

28. $-8 - 3(r - 1) = 2r$

29. $12 - 2k = 5(k - 2) - 6$

30. $7(h + 6) = 6(2h - 3)$

31. $3[2 - 5(q - 1)] = -9$

32. $3[4(1 - 2d) + 3d] = d$

Solve the following equations. **(33 – 42)**

33. $8x - \frac{1}{2} = 4 - \frac{5x}{2}$

34. $\frac{5-x}{4} = 2x - 1$

35. $\frac{9-x}{3} = \frac{x-4}{2}$

36. $5 + 3\left(\frac{x}{2} - 1\right) = x$

37. $-3(3x + 2) = \frac{x}{3} - 6$

38. $12(4 - x) = \frac{4}{3}(1 - 2x)$

39. $\frac{x-1}{3} + \frac{x}{4} = -1$

40. $\frac{3x-5}{2} - x = -\frac{x}{3}$

41. $\frac{2(x-3)}{9} - \frac{x}{6} = 2$

42. $\frac{7-x}{11} - \frac{1-2x}{3} = x$

Applications of Algebraic Equations in One Unknown

Level 1

1. The sum of x and 10 is 25. Find the value of x.

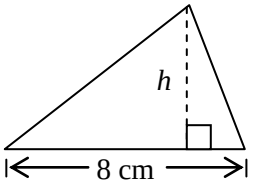
2. The difference between y and $7y$ is 18. Find the value of y.

3. The result of multiplying z by 5 is the same as that of adding 32 to z. Find the value of z.

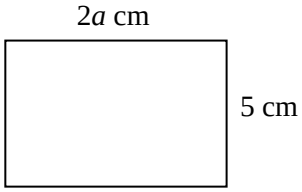
4. Peter has 100 stamps. After using n stamps, he still has 56 stamps. Find the value of n.

5. The total amount of $(m + 1)$ \$2 coins is \$76. Find the value of m.

6. The area of the triangle in the figure is 20 cm^2. If the base of the triangle is 8 cm, find its height h.



7. The perimeter of the rectangle in the figure is 42 cm. Find the value of a.



8. Hayley is x years old now. Patsy is 3 times as old as Hayley. After 5 years, Patsy will be 26 years old. Find the value of x.

9. Mary pays \$100 for k towels and gets a change of \$20. If each towel costs \$16, what is the value of k?

10. There are y girls in a school. The number of boys is less than that of girls by 52. If there are 880 students in the school, what is the value of y?

11. 120 marbles are divided into two groups. The number of marbles in the first group is one-third that of the second group. If there are m marbles in the second group, find the value of m.

12. In a supermarket, the price of an apple is \$3 and the price of an orange is \$$p$. Mrs Chan pays \$42 to buy 5 apples and 6 oranges. Find the value of p.

✌ Level 2

13. Find two consecutive integers whose sum is 85.

14. Ella is a part-time tutor and her hourly wage is $50. She worked *h* hours in a certain week. In the next week, she worked 2 hours more than the previous week. If the total income that Ella got in these 2 weeks is $900, find the value of *h*.

15. There are 16 chickens and some pigs in a farm. The chickens and the pigs have 100 feet in total. How many pigs are there in the farm?

16. 66 sweets are shared between Bonnie and Kitty. If the number of sweets Bonnie gets is 2 more than 3 times that Kitty gets, how many sweets does Kitty get?

17. A piece of 200 cm long wire is cut into two parts and then bent into 2 squares. If the length of each side of one square is 18 cm, find the length of each side of the other square.

18. In a theme park, the price of a child ticket is half of the price of an adult ticket. Mr Lee, Mrs Lee and their two children went to the theme park and they paid $960 for tickets in total. Find the price of an adult ticket.

19. The height of Amy is $\frac{4}{5}$ of Stephen, while the height of Stephen is $\frac{5}{6}$ of Mr Wong. If Mr Wong is taller than Amy by 60 cm, find the height of Mr Wong.

20. A sum of $500 is shared among *A*, *B* and *C*. *B* receives $80 more than *A*, while *C* receives $40 more than *B*. *A* claims that the amount he receives is less than half of the amount of *C*. Do you agree? Explain your answer.

21. Desmond and Jay have $800 in total. If Desmond gives $160 to Jay, Jay will have 4 times as much as Desmond has. How much does Desmond have originally?

22. Eva and Howard are walking along the same straight road in the same direction. Eva is 100 m ahead of Howard. The walking speed of Howard is twice that of Eva. If it takes 40 s for Howard to overtake Eva, find the walking speed for each of them.

23. The net weights of two packages of nuts *A* and *B* are 350 g and 280 g respectively. In order to make the net weight of package *A* 4 times as that of package *B*, Ivy claims that at least 150 g of nuts must be taken from package *B* to package *A*. Do you agree? Explain your answer.

Multiple Choice Questions

☝ Level 1

1. Which of the following is an algebraic equation in one unknown?

A. $4x = y$

B. $2x + 9 = 0$

C. $y - 1$

D. $xy = 1$

2. Which of the following is the solution of $6 - 15x = 9$?

A. $x = -\frac{1}{5}$ **B.** $x = -\frac{1}{3}$

C. $x = \frac{1}{5}$ **D.** $x = \frac{1}{3}$

3. The solution of $5(2x - 1) = -6$ is

A. $x = -1$.

B. $x = -0.1$.

C. $x = 0.1$.

D. $x = 1$.

4. The root of $\frac{5 + 2a}{3} = -1$ is

A. -4.

B. -1.

C. 1.

D. 4.

5. Solve the equation $3(2 - x) + 2(3 - x) = x$.

A. $x = -3$

B. $x = -2$

C. $x = 2$

D. $x = 3$

6. Which of the following equations has the root 2?

A. $\frac{y}{6} - 1 = \frac{2y}{3}$

B. $\frac{y}{6} - 1 = -\frac{2y}{3}$

C. $\frac{y}{6} + 1 = \frac{2y}{3}$

D. $\frac{y}{6} + 1 = -\frac{2y}{3}$

7. If 4 is added to 2 times of a number x, the sum is equal to the number x. Which of the following equations can represent the above word phrase?

A. $(4 + 2)x = x$

B. $2x + 4 = x$

C. $4 \times 2 + x = 0$

D. $2 + 4x = x$

8. Sammi saved \$600 last month. Daniel saved \$$x$ more than Sammi. If their total savings last month was \$1500, which of the following equations can be used to find the value of x?

A. $600 + x = 1500$

B. $600 - x = 1500$

C. $600 + (600 + x) = 1500$

D. $600 + (600 - x) = 1500$

Level 2

9. Given that $a = b$, which of the following are correct?

I. $a + 10 = b + 10$

II. $2a - 5 = 2b - 5$

III. $\frac{a}{3} = \frac{b}{3}$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

10. Ricky solves the equation $\frac{-5x-(1+2x)}{2} = 10$ as follows:

Step 1 $-5x-(1+2x) = 20$

Step 2 $-5x-1+2x = 20$

Step 3 $-3x-1 = 20$

Step 4 $-3x = 21$

Step 5 $x = -7$

Which step does Ricky first make mistake?

A. Step 1

B. Step 2

C. Step 3

D. Step 4

11. Given that $2x + k = 9$, where k is a constant. If the root of the equation is 5, find the value of $k - 1$.

A. –2

B. –1

C. 1

D. 2

12. \$360 is shared among *A* and *B*. The amount *A* receives is twice that of *B*. Find the amount *A* receives.

A. \$120

B. \$180

C. \$240

D. \$300

13. The price of an LCD monitor is \$600 more than one-third of the price of a portable computer. If the price of the LCD monitor is \$2200, what is the price of the portable computer?

A. \$1800

B. \$2800

C. \$4800

D. \$6400

14. The length of a rectangle is 4 cm more than the width. If the perimeter of the rectangle is 28 cm, find the area of the rectangle.

A. 9 cm^2

B. 14 cm^2

C. 27 cm^2

D. 45 cm^2

★ **1.** Cross-topic The following table shows the test results of five students.

Student	*A*	*B*	*C*	*D*	*E*
Score	67	80	x	90	$1.25x$

The average score of students *D* and *E* is 13.5 marks higher than the average score of students *A*, *B* and *C*.

(a) Find x.

(b) Hence, find the average score of the five students.

★ **2.** Cross-topic In a game of 10 rounds, a person gets +5 points each round if he wins and gets −3 points each round if he loses. No points are awarded for a draw.

(a) Nancy loses 3 rounds and gets a total of +1 point. How many rounds does she win and draw respectively?

(b) It is known that Tony wins the first 4 rounds of the game. He claims that his score must be higher than Nancy's score after the 10 rounds. Do you agree? Explain your answer.

★ **3.** Solve the following equations.

(a) $8x+2(x+1)-4(3x-2)+1=10\left(x+\frac{1}{2}\right)$ **(b)** $\frac{2}{3}\left[\frac{x}{2}-6\left(\frac{1-x}{2}+\frac{2x}{3}\right)\right]=\frac{x}{6}-5$

★ **4.** **(a)** Solve the equation $4(x-9)+3(x-9)+2(x-9)+(x-9)=55+5(x-9)$.

(b) Using the result in (a), solve the equation

$$4\left(1-\frac{2}{y}\right)+3\left(1-\frac{2}{y}\right)+2\left(1-\frac{2}{y}\right)+\left(1-\frac{2}{y}\right)=55+5\left(1-\frac{2}{y}\right).$$

★★ **5.** The amount Tim spends on entertainment each month is $\frac{2}{3}$ of that of his sister, Mary. If Tim spends \$150 more and Mary spends \$150 less each month, then Mary's expenditure becomes $\frac{2}{3}$ of Tim's.

(a) How much does each of them spend on entertainment each month?

(b) Tim and Mary want to buy a bicycle and a TV game. The amount needed is \$140 less than twice of the total amount they spend on entertainment each month. If the price of the bicycle is $\frac{4}{13}$ of that of the TV game, what is the price of the TV game?

★★ **6.** Michelle and Paul received red packets during the Chinese New Year. The amount of Paul's red packet money is greater than $\frac{5}{6}$ of that of Michelle by \$80. Michelle spent \$300 in buying

books and donated $\frac{1}{5}$ of her remaining amount to charity. Paul only donated $\frac{1}{3}$ of his red packet money to charity. It is known that they had the same amount of red packet money left. Who received more red packet money? Explain your answer.

★★ **7.** Cross-topic In a 2 km race, Jenny ran the first n m at an average speed of 3 m/s and the rest of the race at an average speed of 2 m/s.

(a) Express, in terms of n, the time taken for Jenny to finish the first n m race.

(b) If Jenny took 15 minutes to finish the whole race, find the value of n.

★★ **8.** Cross-topic Figure (a) shows a kite whose height is 16 cm. It is then folded along AB and DE respectively to form trapezium $ABED$, where vertices C and F meet each other at G, as shown in Figure (b). It is known that DE is a line 6 cm from vertex F, AB = 7 cm and DE = 3 cm.

(a) What is the height of $\triangle ABC$ in Figure (a)?

(b) A student claims that the area of $\triangle ABG$ is greater than that of $\triangle DEG$ in Figure (b). Do you agree? Explain your answer.

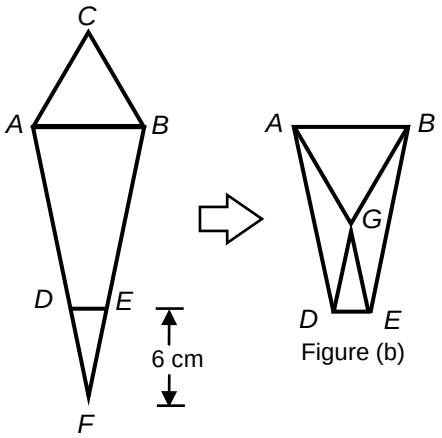
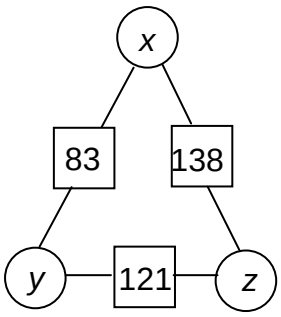


Figure (a) Figure (b)

★★ **9.** In the figure, the number in each square is the sum of the numbers in the circles at two ends of the corresponding lines. (e.g. $x + y = 83$)

(a) Find $x + y + z$.

(b) Find the values of x, y and z.



★★★ **10.** A ferry travels from pier P to pier Q. The travelling time downstream and upstream are 3 hours and 4 hours respectively. If the water flows at a speed of 1.5 km/h, find the distance between the two piers.

Answer
Exercise 3A

Level 1

1.	-3	**2.**	-8	**3.**	8
4.	12	**5.**	15	**6.**	$-\frac{9}{2}$
7.	3	**8.**	4	**9.**	-1
10.	5	**11.**	$\frac{1}{2}$	**12.**	$-\frac{1}{12}$
13.	9	**14.**	-11	**15.**	-5
16.	10	**17.**	8	**18.**	6
19.	-14	**20.**	13	**21.**	27
22.	22	**23.**	-80	**24.**	16

Level 2

25.	$\frac{1}{5}$	**26.**	$-\frac{9}{2}$	**27.**	-0.6
28.	10	**29.**	1	**30.**	11
31.	-2	**32.**	0	**33.**	7
34.	$\frac{25}{2}$	**35.**	28	**36.**	13
37.	-6	**38.**	16		

Exercise 3B

Level 1

1.	1	**2.**	2	**3.**	2
4.	-4	**5.**	-5	**6.**	$\frac{3}{2}$
7.	-2	**8.**	-1	**9.**	-2
10.	1	**11.**	-6	**12.**	4
13.	-5	**14.**	-2	**15.**	$\frac{2}{3}$
16.	$\frac{1}{2}$	**17.**	3	**18.**	1
19.	2	**20.**	12	**21.**	-6
22.	15	**23.**	-4	**24.**	$\frac{21}{17}$

Level 2

25.	-2	**26.**	3	**27.**	2
28.	-1	**29.**	4	**30.**	12
31.	2	**32.**	$\frac{3}{4}$	**33.**	$\frac{3}{7}$
34.	1	**35.**	6	**36.**	-4
37.	0	**38.**	5	**39.**	$-\frac{8}{7}$
40.	3	**41.**	48	**42.**	$\frac{5}{7}$

Exercise 3C

Level 1

1.	15	**2.**	3	**3.**	8
4.	44	**5.**	37	**6.**	5 cm
7.	8	**8.**	7	**9.**	5
10.	466	**11.**	90	**12.**	4.5

Level 2

13.	42, 43	**14.**	8	**15.**	17
16.	16	**17.**	32 cm	**18.**	$320
19.	180 cm	**20.**	yes	**21.**	$320

22. Eva: 2.5 m/s, Howard: 5 m/s

23. yes

Exercise 3D

Level 1

1.	B	**2.**	A	**3.**	B	**4.**	A
5.	C	**6.**	C	**7.**	B	**8.**	C

Level 2

9.	D	**10.**	B	**11.**	A	**12.**	C
13.	C	**14.**	D				

Exercise 3E

1. **(a)** 60 **(b)** 74.4

2. **(a)** win: 2 rounds, draw: 5 rounds

(b) yes

3. **(a)** $\frac{1}{2}$ **(b)** 6

4. **(a)** 20 **(b)** $-\frac{1}{5}$

5. **(a)** Tim: \$300, Mary: \$450

(b) \$1040

6. Michelle

7. **(a)** $\frac{n}{3}$ s **(b)** 600

8. **(a)** 2 cm **(b)** no

9. **(a)** 171

(b) $x = 50$, $y = 33$, $z = 88$

10. 36 km

English Version

2020 S1 Summer Exercise – Unit 9 Polynomial Laws of Positive Integral Indices

Level 1

Simplify the following expressions. **(1 – 9)**

1. **(a)** $h \times h^2$ **(b)** $b(b^5)$

2. **(a)** $m^2(m^3)$ **(b)** $a^3 \times a^4$

3. **(a)** $2x^3 \times x^2$ **(b)** $(y^5)(3y^3)$

4. **(a)** $-5t^4 \times 2t$ **(b)** $(-4r^4)(-2r^2)$

5. **(a)** $2v^3 \times (-3v^7)$ **(b)** $(-6k^2)(-4k^6)$

6. **(a)** $a^{10} \div a$ **(b)** $\dfrac{t^{20}}{t^5}$

7. **(a)** $m^6 \div m^3$ **(b)** $b^2 \div b^8$

8. **(a)** $4x^{12} \div x^4$ **(b)** $\dfrac{7m^2}{m^9}$

9. **(a)** $\dfrac{6k^{10}}{-2k^3}$ **(b)** $-16d^2 \div (-8d^8)$

Simplify the following expressions. **(10 – 16)**

10. **(a)** $a^5 \times a^4 \times a^3$ **(b)** $y^3 \times y^2 \times y^6$

11. **(a)** $2b \times 3b^4 \times b^4$ **(b)** $(-3x) \times x^3 \times 4x^7$

12. **(a)** $a^{18} \div a \div a^7$ **(b)** $n^9 \div n^6 \div n^5$

13. **(a)** $18t^{14} \div t^3 \div 2t^8$ **(b)** $(-24m^5) \div (-2m) \div m^3$

14. **(a)** $a^{12} \div a^2 \times a^5$ **(b)** $k^3 \times k^4 \div k^9$

15. **(a)** $a^{20} \div 10a^9 \times 5a$ **(b)** $\dfrac{x^3 \times 8x^6}{4x}$

16. **(a)** $\dfrac{-16r^{10}}{-4r^5 \times 2r}$ **(b)** $\dfrac{6s^3}{10s^5 \times 3s^2}$

Level 2

Simplify the following expressions. **(17 – 24)**

17. **(a)** $b^2 \times ab^2$ **(b)** $p^4q \times p^2q^3$

18. **(a)** $(c^4d^2)(cd^3)$ **(b)** $(xy^2)(6x^7y^6)$

19. **(a)** $4h^2k^3 \times h^3k^3$ **(b)** $m^5n^6 \times (-3m^4n^8)$

20. **(a)** $7a^2b \times 3ab^2$ **(b)** $(-2r^5s^3)(-9r^6s^7)$

21. **(a)** $b^{10} \div a^4b^5$ **(b)** $\dfrac{c^9d^3}{c^6d^5}$

22. **(a)** $m^{12}n^5 \div m^6n^4$ **(b)** $3p^6q^4 \div (-p^2q^3)$

23. **(a)** $\dfrac{r^6s^7}{4r^3s^4}$ **(b)** $-8h^7k^2 \div (h^5k^4)$

24. **(a)** $4c^6d^5 \div 14c^5d^4$ **(b)** $-9a^7b^4 \div (-3a^3b^5)$

Simplify the following expressions. **(25 – 26)**

25. **(a)** $m^4n^7 \times m^2 \times mn^5$ **(b)** $\dfrac{x^3y^9}{(x^5y^6)(2x^4)}$

26. **(a)** $a^7b \times 2a^3b^5 \div a^9b^4$ **(b)** $-2h^3k^2 \div h^{12}k^9 \times (-12h^5k^6)$

Polynomials

Level 1

1. Determine whether the following algebraic expressions are monomials.

a, $5b + 1$, $\frac{2}{c}$, $6xy$, $-3h^2$, $\frac{7mn}{8}$

2. Write down the coefficients and the degrees of the following monomials.

(a) $3x$ **(b)** $-m^4$

(c) $-8x^2y$ **(d)** $\frac{pq^3}{2}$

3. In each of the following pairs of terms, determine whether they are like terms or unlike terms.

(a) x, $2x$ **(b)** $-5abc$, bca

(c) xy, x^2y^2 **(d)** $-4a^3$, $\frac{a^3}{7}$

4. Complete the following table.

	Polynomial	Number of terms	Coefficient of			Constant term	Degree of polynomial
			x^3	x^2	x		
(a)	$5x^3+6x^2+3x+2$						
(b)	$2x^3+1-3x$						
(c)	$-12+\frac{x^2}{2}$						

5. Complete the following table.

	Polynomial	Number of terms	Constant term	Degree of polynomial
(a)	$1-7a^2b$			
(b)	$-8m^2-2mn^2-6$			
(c)	$4x^3y^3-5x^4y+xy-3y^5$			

Arrange the terms of the following polynomials in descending powers of the variables, and in ascending powers of the variables. **(6 – 7)**

6. **(a)** $5x - 6 + 3x^2$ **(b)** $3y^2 + 8y - 6y^3$

7. **(a)** $7x^2 - 12x - 8 - x^3$ **(b)** $-y + 2 - 5y^4 - y^3$

Simplify the following polynomials. **(8 – 12)**

8. **(a)** $5x + 2x$ **(b)** $4h^2 - h^2$

9. **(a)** $7y - 9y$ **(b)** $-3k^2 + 10k^2$

10. **(a)** $2d + 5d + 3$ **(b)** $-8e^2 - 7e + 16e^2$

11. **(a)** $-5n - 2m + 6m + 4n$ **(b)** $2p^2 + 8p - 3p^2 + p$

12. **(a)** $-4b + 12 - 6b - 10 + 11b$ **(b)** $3y^2 - 2y - 5 - 6y - 7y^2$

Find the values of the following polynomials by substituting the given values of the variables. **(13 – 16)**

13. **(a)** $2a + 3 \quad [a = 0]$ **(b)** $-5b + 7 \quad [b = 1]$

14. **(a)** $4y^2 - 3y \quad [y = -3]$ **(b)** $-k + \frac{1}{2}k^3 \quad [k = -2]$

15. **(a)** $-2a + 3a^2 - 7 \quad [a = 2]$ **(b)** $-4a^2 - 6a + 3 \quad [a = -2]$

16. **(a)** $ab - b^2 \quad [a = 4, b = 3]$ **(b)** $a^3 - 4a^2b + b^2 \quad [a = -1, b = -1]$

Level 2

Simplify the following polynomials. **(17 – 18)**

17. **(a)** $4ab + 3cd + 7ab + 2cd$ **(b)** $7pq - 3rs - 2pq - 5rs$

18. **(a)** $xz + 2yz + 3zy - 7zx$ **(b)** $-3a^2b - 7ab^2 + 10ba^2 - 5b^2a$

Simplify the following polynomials and arrange the terms in descending powers of x. **(19 – 20)**

19. **(a)** $8x^2 - 1 - 3x^2 - 6x^2$ **(b)** $5x^3 + 2x - 6x^3 + 7x$

20. **(a)** $x + 7x^3 + 5x^2 - 3x^3 + 8x^2$ **(b)** $14 - 12x^2 - 4x^4 - 11 - 5x^4$

Simplify the following polynomials and arrange the terms in ascending powers of y. **(21 – 22)**

21. **(a)** $3y^3 + 2y - 6y + 10y^3$ **(b)** $-2y^4 + 7y^2 + 5y^2 - 10y^4$

22. **(a)** $3y^2 - 2y^3 + 12 - 6y^3 + 4y^2$ **(b)** $6y^4 + 2y^2 - 8y^4 - 8y^2 - 5y^4$

23. Arrange the terms of $3xy^3 + 2x^2y - 6y^2x^4 - 10y^4$

(a) in ascending powers of y,

(b) in descending powers of x.

24. Consider the polynomial $-4x^2y^3 - xy^2 + 7x^3y - 2xy^2 + x^2y^3$.

(a) Simplify and arrange the terms in ascending powers of x.

(b) Find the degree of the polynomial.

25. Find the value of the polynomial $h^2 + \frac{1}{2}h - 1$ in each of the following cases.

(a) $h = \frac{1}{2}$ **(b)** $h = -2$

26. Find the value of the polynomial $-x^2y^2 + 3xy - 2y$ in each of the following cases.

(a) $x = 2, y = 1$ **(b)** $x = \frac{1}{3}, y = -3$

27. The numbers of books that Amy, Ben and Candy read last week were $x + y$, $2y - x$ and $xy - 1$ respectively. Miss Lee wants to give a present to the one who read the greatest number of books last week. Suppose $x = 3$ and $y = 4$. To whom will Miss Lee give the present? Explain your answer.

28. In $\triangle ABC$, the lengths of AB, BC and AC are $(2y - 3x)$ cm, $(y - 6x)$ cm and $(4x + 5y)$ cm respectively. Suppose $x = -3$ and $y = 7$. Which type of triangle does $\triangle ABC$ belong to?

29. The perimeters of three squares A, B and C are $(x^2 + 4x)$ cm, $(x^3 + 8)$ cm and $(7x + 6)$ cm respectively. Suppose $x = 2$.

(a) Find the perimeter of each square.

(b) Steven claims that square B has the greatest area. Do you agree? Explain your answer.

Addition and Subtraction of Polynomials

Level 1

Simplify the following expressions. **(1 – 9)**

1. **(a)** $(5p + 2) + (3p – 2)$ **(b)** $(3x – 4) – (4x + 1)$

2. **(a)** $(3h – k) + (h – 2k)$ **(b)** $(7a + 2b) – (4a – 3b)$

3. **(a)** $(2x + 6y) + (–2y + 3x)$ **(b)** $(–s – 8t) – (3t – 5s)$

4. **(a)** $(–2q^2 + 4) + (q^2 – 5)$ **(b)** $(7y^2 + 2) – (6y^2 – 3)$

5. **(a)** $(6v^2 – 2v) + (7v + v^2)$ **(b)** $(5c^2 – 3c) – (–2c + 4c^2)$

6. **(a)** $–(2m^2 + n^2) + (m^2 – 4n^2)$ **(b)** $–(4x^2 + 2y^2) – (5x^2 + y^2)$

7. **(a)** $(a – 3) + (2a – 7b + 6)$ **(b)** $(3s – t + 4) – (2s – 3t)$

8. **(a)** $(h – 3k + 1) + (2h – 3k + 2)$ **(b)** $(m – 6n – 4) – (2m + 9n – 3)$

9. **(a)** $(5k^2 – 2k + 6) + (k^2 + 4k – 8)$ **(b)** $(3v^2 – 5v – 2) – (v^2 – 6v + 5)$

10. Simplify the following expressions and arrange the terms in descending powers of x.

(a) $(3 + 5x + x^2) + (3x^2 + 7x)$ **(b)** $(5x – 3) – (7x^2 – 5x – 1)$

11. Simplify the following expressions and arrange the terms in ascending powers of y.

(a) $(–7y + 4y^2 – 6) + (5y^2 + 9 + 10y)$ **(b)** $(8y – 9y^3 + 5) – (–2y^2 – 6y^3 + 5y)$

Complete the following operations. **(12 – 14)**

12. **(a)**
$$\begin{array}{rl} & 3x + 4y \\ +) & 5x - y \\ \hline \end{array}$$

(b)
$$\begin{array}{rl} & -5x - 2y \\ -) & 3x - y \\ \hline \end{array}$$

13. **(a)**
$$\begin{array}{rl} & 2a + 3b + 5 \\ +) & 4a - b - 1 \\ \hline \end{array}$$

(b)
$$\begin{array}{rl} & h^2 + 4k^2 \\ -) & 2h^2 - 3k^2 + 1 \\ \hline \end{array}$$

14. **(a)**
$$\begin{array}{rr} & 6m^2 + 2mn + 4n^2 \\ +) & 3mn - 5n^2 \\ \hline \end{array}$$

(b)
$$\begin{array}{rr} & -2x^2 + 4xy \\ -) & 3x^2 - 5xy - 2y^2 \\ \hline \end{array}$$

Level 2

Simplify the following expressions. **(15 – 18)**

15. **(a)** $(a^2 + ab) + (b^2 - ab - a^2)$ **(b)** $(hk - k^2) - (-k^2 + hk - h^2)$

16. **(a)** $(xy - x^2 + 2y^2) + (2x^2 - 6yz - y^2)$ **(b)** $(-a^2 + 8ab - 6ab^2) - (7ba + b^2a + b^2)$

17. **(a)** $(p + r) + (q - 2r) + (p - 3q)$ **(b)** $(a + 5b) - (2c - b) + (a - c)$

18. **(a)** $(a^2 - 4a) + (2a^2 + 6) - (3a - 1)$ **(b)** $(5m^2 - 3m) - (8 - 3m) - (4m^2 - 7)$

19. Simplify the following expressions and arrange the terms in descending powers of a.

(a) $(-a^2 + 3ab) - (ab - 4a^2 + b^2)$

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

20. Simplify the following expressions and arrange the terms in ascending powers of b.

(a) $(ab^2 + a^2b - b^3) + (-2ab^2 - 3b^3)$

(b) $(2b - b^2) - (2b^2 + 4) - (b - 6)$

21. **(a)** Simplify $(11 + 2x^2 - 12x) - (-5x + 12)$ and arrange the terms in descending powers of x.

(b) Find the value of the above expression when $x = -1$.

22. Originally, there are $(4a + 3)$ students studying in the library. Later, $(a^2 + 1)$ students come and $(2a + 5)$ students leave the library.

(a) How many students are there in the library now?

(b) Suppose each student occupies only one seat and there are 50 seats in the library. If $a = 5$, how many empty seats are there now?

23. Stephy prepares $(4x^2 + 3x - 2)$ pieces of fried and non-fried chicken for a party, of which $(3x^2 - 6)$ pieces are non-fried chicken. It is given that $(6x + 2)$ guests come to Stephy's party.

(a) How many pieces of fried chicken does Stephy prepare?

(b) Suppose $x = 3$. Is it possible for everyone, including Stephy, to have a piece of fried chicken? Explain your answer.

Multiplication of Polynomials

Level 1

Expand the following expressions. **(1 – 11)**

1. **(a)** $2(a + 3)$ **(b)** $(b – 5)(6)$

2. **(a)** $4(3c + 1)$ **(b)** $(7 – 2d)(3)$

3. **(a)** $–7(2e + 1)$ **(b)** $(8f – 3)(–2)$

4. **(a)** $4(x – y)$ **(b)** $–5(x – 2y)$

5. **(a)** $r(7s – 2t)$ **(b)** $(3b – 5c)(2a)$

6. **(a)** $g(3g + 2)$ **(b)** $(5j – 4)(j)$

7. **(a)** $–3x(5 – 6x)$ **(b)** $(–5y – 1)(–4y)$

8. **(a)** $5h^2(h – 3)$ **(b)** $(m – 4)(–2m^2)$

9. **(a)** $–2(x – y + 1)$ **(b)** $(h + k – 3)(4)$

10. **(a)** $–3x(x + 2y – 4z)$ **(b)** $(p – 3r + 5q)(2r)$

11. **(a)** $6t(3t^2 – 2t + 1)$ **(b)** $(4s^2 – s + 3)(–7s)$

Expand the following expressions. **(12 – 20)**

12. **(a)** $(c + 1)(c + 3)$ **(b)** $(f – 1)(f – 9)$

13. **(a)** $(2x + 1)(x – 3)$ **(b)** $(3y – 2)(y + 1)$

14. **(a)** $(2 – 7t)(4 – 3t)$ **(b)** $(5 – 4w)(2 + 5w)$

15. **(a)** $(9 + 4m)(2m – 5)$ **(b)** $(6n – 1)(2 – 3n)$

16. **(a)** $(x + y)(2x + y)$ **(b)** $(3h – k)(h – k)$

17. **(a)** $(m + n)(m – n)$ **(b)** $(2p – q)(2p + q)$

18. **(a)** $(4a + 5b)(2a – 3b)$ **(b)** $(7x – 2y)(4x – 3y)$

19. **(a)** $(s + 4)^2$ **(b)** $(2c – 3)^2$

20. **(a)** $(–h + 3k)^2$ **(b)** $(–6x – 5y)^2$

Complete the following operations. **(21 – 23)**

21. **(a)**
$$\begin{array}{rr} & 4a-5 \\ \times) & 2a+3 \\ \hline \end{array}$$

(b)
$$\begin{array}{rr} & 2d-7 \\ \times) & d-8 \\ \hline \end{array}$$

22. **(a)**
$$\begin{array}{rr} & 3p+4q \\ \times) & 2p+q \\ \hline \end{array}$$

(b)
$$\begin{array}{rr} & -7x+2y \\ \times) & 6x-2y \\ \hline \end{array}$$

23. **(a)**
$$\begin{array}{rr} & 2m^2+3m+5 \\ \times) & m-4 \\ \hline \end{array}$$

(b)
$$\begin{array}{rr} & 3h^2-4h-1 \\ \times) & h^2-6 \\ \hline \end{array}$$

Level 2

Expand and simplify the following expressions, and arrange the terms in descending powers of the variables. **(24 – 26)**

24. **(a)** $3(a + 1) + 2(a + 1)$ **(b)** $6(c – 1) – 2(c + 5)$

25. **(a)** $2(2b + 5) + 3(–b – 2)$ **(b)** $5(–d + 4) – 2(4d – 1)$

26. **(a)** $–e(e + 2) + 3e(e – 1)$ **(b)** $3f(3f – 2) – 2f(2f + 4)$

Expand and simplify the following expressions, and arrange the terms in ascending powers of the variables. **(27 – 28)**

27. **(a)** $(a + 4)(a – 5) + (4a + 12)$ **(b)** $(x – 3)(2x + 1) – 3(2x + 4)$

28. **(a)** $2a^2 + (2a – 7)^2$ **(b)** $(3x + 2)^2 – (4x – 7)(5)$

Expand and simplify the following expressions. **(29 – 31)**

29. **(a)** $–ab(2a^2 + 4ab – b^2)$ **(b)** $(4xy – 2y^2 – 3x^2)(4yz)$

30. **(a)** $(g^2 – g + 1)(3 + g)$ **(b)** $(4p^2 + 3p + 2)(–p – 1)$

31. **(a)** $–4h(h + 3)(3h – 5)$ **(b)** $2r(3r + 2t)(r + t)$

32. Jeffrey bought x melons at \$40 each and $(x - 1)$ watermelons at $\$(2x + 7)$ each. How much did he pay for the melons and the watermelons?

33. A wire of length $(4x + 8y)$ cm is bent to form a square.

(a) Find the length of the side of the square in terms of x and y.

(b) Find the area of the square in terms of x and y.

34. Betty goes to the supermarket to buy $(2a + 3)$ cans of lemon juice at \$7 each and $(a + 1)$ packs of potato chips at $\$(3a - 2)$ each for her daughter's birthday party.

(a) How much does Betty pay for the lemon juice and the potato chips?

(b) Suppose $a = 4$. Could Betty buy the above items with no more than \$120? Explain your answer.

Multiple Choice Questions

Level 1

1. $\dfrac{6a^2b^4}{2ab^2} =$

A. $4a^3b^3$

B. $4ab^2$

C. $3a^3b^3$

D. $3ab^2$

2. Simplify $4p^6 \times (-2p^4)$.

A. -8

B. $-2p^2$

C. $-8p^{10}$

D. $-6p^{24}$

3. Which of the following is a monomial?

A. $2x + 1$

B. $3x^5$

C. $\dfrac{2}{x}$

D. $\dfrac{x^2}{y}$

4. Find the constant term of the polynomial $6x^3 - x^2 + 4x - 5$.

A. -5

B. -1

C. 4

D. 5

5. Which of the following is NOT arranged in descending powers of x?

A. $-2x^7 - 3x^6 - 4x^5 - 5x^4$

B. $10x^3 + 9x^2 + 8x + 7$

C. $5x^4 - 6x^3 + 7x^2 - 8x$

D. $9x^2 + 8x^3 + 7x^4 + 6x^5$

6. Which of the following are like terms?

A. $2x,\ 2x^2$

B. $3x^5y,\ xy^5$

C. $4xyz,\ zyx$

D. $\frac{x^2}{2},\ \frac{2}{x^2}$

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

A. $-2a-2b$

B. $-2a+8b$

C. $6a-2b$

D. $6a+8b$

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

A. $-4a^2+4a-10$

B. $-3a^2+2a-2$

C. $-2a^2+4a-10$

D. $-2a^2+4a+2$

9. Expand $(-2y)(6-4y)$.

A. $-16y$

B. $-12y+8y^2$

C. $-8y-6y^2$

D. $-4y^2$

10. $(8a+b)(a-3b)=$

A. $8a^2-3b^2$

B. $8a^2-24ab+3b^2$

C. $8a^2-23ab-3b^2$

D. $8a^2+25ab+3b^2$

Level 2

11. Simplify $(-3p^3q^2r)(-7pq^3r^4)$.

A. $21p^3q^6r^4$

B. $21p^4q^5r^5$

C. $-10p^3q^6r^4$

D. $-10p^4q^5r^5$

12. $\frac{2a+3a}{2a\times 3a}=$

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

B. 1

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

D. $\frac{5}{6a}$

13. What is the degree of the polynomial $5a^3+3a^2b^2c^2-2abc-b^5$?

A. 4

B. 5

C. 6

D. 7

14. Find the value of $-\frac{x^2}{8}+\frac{xy}{4}+3y^2$ when $x = 2$ and $y = -1$.

A. 3

B. 2

C. –3

D. –4

15. Simplify $(-x+5x^2)-(1-4x)+(2x^2-3)$.

A. $7x^2-5x-2$

B. $7x^2+3x-4$

C. $7x^2-5x-4$

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

16. $-4(2a-1)+3(-a+2)=$

A. $-11a+10$

B. $-11a+2$

C. $-5a+2$

D. $-5a+1$

Answers

Exercise 12A

Level 1

1. **(a)** h^3 **(b)** b^6

2. **(a)** m^5 **(b)** a^7

3. **(a)** $2x^5$ **(b)** $3y^8$

4. **(a)** $-10t^5$ **(b)** $8r^6$

5. **(a)** $-6v^{10}$ **(b)** $24k^8$

6. **(a)** a^9 **(b)** t^{15}

7. **(a)** m^3 **(b)** $\frac{1}{b^6}$

8. **(a)** $4x^8$ **(b)** $\frac{7}{m^7}$

9. **(a)** $-3k^7$ **(b)** $\frac{2}{d^6}$

10. **(a)** a^{12} **(b)** y^{11}

11. **(a)** $6b^9$ **(b)** $-12x^{11}$

12. **(a)** a^{10} **(b)** $\frac{1}{n^2}$

13. **(a)** $9t^3$ **(b)** $12m$

14. **(a)** a^{15} **(b)** $\frac{1}{k^2}$

15. **(a)** $\frac{a^{12}}{2}$ **(b)** $2x^8$

16. **(a)** $2r^4$ **(b)** $\frac{1}{5s^4}$

Level 2

17. **(a)** ab^4 **(b)** p^6q^4

18. **(a)** c^5d^5 **(b)** $6x^8y^8$

19. **(a)** $4h^5k^6$ **(b)** $-3m^9n^{14}$

20. **(a)** $21a^3b^3$ **(b)** $18r^{11}s^{10}$

21. **(a)** $\frac{b^5}{a^4}$ **(b)** $\frac{c^3}{d^2}$

22. **(a)** m^6n **(b)** $-3p^4q$

23. **(a)** $\frac{r^3s^3}{4}$ **(b)** $-\frac{8h^2}{k^2}$

24. **(a)** $\frac{2cd}{7}$ **(b)** $\frac{3a^4}{b}$

25. **(a)** m^7n^{12} **(b)** $\frac{y^3}{2x^6}$

26. **(a)** $2ab^2$ **(b)** $\frac{24}{h^4k}$

Exercise 12B

Level 1

1. a, $6xy$, $-3h^2$, $\frac{7mn}{8}$

2. **(a)** coefficient = 3, degree = 1

(b) coefficient = –1, degree = 4

(c) coefficient = –8, degree = 3

(d) coefficient = $\frac{1}{2}$, degree = 4

3. **(a)** like terms **(b)** like terms

(c) unlike terms **(d)** like terms

4.

	Number of terms	Coefficient of		
		x^3	x^2	x
(a)	4	5	6	3
(b)	3	2	0	–3
(c)	2	0	$\frac{1}{2}$	0

	Constant term	Degree of polynomial
(a)	2	3
(b)	1	3
(c)	–12	2

5.

	Number of terms	Constant term	Degree of polynomial
(a)	2	1	3
(b)	3	–6	3
(c)	4	0	6

6. **(a)** descending: $3x^2 + 5x - 6$
ascending: $-6 + 5x + 3x^2$
(b) descending: $-6y^3 + 3y^2 + 8y$
ascending: $8y + 3y^2 - 6y^3$

7. **(a)** descending: $-x^3 + 7x^2 - 12x - 8$
ascending: $-8 - 12x + 7x^2 - x^3$
(b) descending: $-5y^4 - y^3 - y + 2$
ascending: $2 - y - y^3 - 5y^4$

8. **(a)** $7x$ **(b)** $3h^2$

9. **(a)** $-2y$ **(b)** $7k^2$

10. **(a)** $7d + 3$ **(b)** $8e^2 - 7e$

11. **(a)** $-n + 4m$ **(b)** $-p^2 + 9p$

12. **(a)** $b + 2$ **(b)** $-4y^2 - 8y - 5$

13. **(a)** 3 **(b)** 2

14. **(a)** 45 **(b)** –2

15. **(a)** 1 **(b)** –1

16. **(a)** 3 **(b)** 4

Level 2

17. **(a)** $11ab + 5cd$ **(b)** $5pq - 8rs$

18. **(a)** $-6xz + 5yz$ **(b)** $7a^2b - 12ab^2$

19. **(a)** $-x^2 - 1$ **(b)** $-x^3 + 9x$

20. **(a)** $4x^3 + 13x^2 + x$ **(b)** $-9x^4 - 12x^2 + 3$

21. **(a)** $-4y + 13y^3$ **(b)** $12y^2 - 12y^4$

22. **(a)** $12 + 7y^2 - 8y^3$ **(b)** $-6y^2 - 7y^4$

23. **(a)** $2x^2y - 6y^2x^4 + 3xy^3 - 10y^4$
(b) $-6y^2x^4 + 2x^2y + 3xy^3 - 10y^4$

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

25. **(a)** $-\frac{1}{2}$ **(b)** 2

26. **(a)** 0 **(b)** 2

27. Candy **28.** isosceles triangle

29. **(a)** square *A*: 12 cm, square *B*: 16 cm, square *C*: 20 cm
(b) no

Exercise 12C

Level 1

1. **(a)** $8p$ **(b)** $-x - 5$

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

3. **(a)** $5x + 4y$ **(b)** $4s - 11t$

4. **(a)** $-q^2 - 1$ **(b)** $y^2 + 5$

5. **(a)** $7v^2 + 5v$ **(b)** $c^2 - c$

6. **(a)** $-m^2 - 5n^2$ **(b)** $-9x^2 - 3y^2$

7. **(a)** $3a - 7b + 3$ **(b)** $s + 2t + 4$

8. **(a)** $3h - 6k + 3$ **(b)** $-m - 15n - 1$

9. **(a)** $6k^2 + 2k - 2$ **(b)** $2v^2 + v - 7$

10. **(a)** $4x^2 + 12x + 3$ **(b)** $-7x^2 + 10x - 2$

11. **(a)** $3 + 3y + 9y^2$ **(b)** $5 + 3y + 2y^2 - 3y^3$

12. **(a)** $8x + 3y$ **(b)** $-8x - y$

13. **(a)** $6a + 2b + 4$ **(b)** $-h^2 + 7k^2 - 1$

14. **(a)** $6m^2 + 5mn - n^2$ **(b)** $-5x^2 + 9xy + 2y^2$

Level 2

15. **(a)** b^2 **(b)** h^2

16. **(a)** $xy + x^2 + y^2 - 6yz$
(b) $-a^2 + ab - 7ab^2 - b^2$

17. **(a)** $2p - r - 2q$ **(b)** $2a + 6b - 3c$

18. **(a)** $3a^2 - 7a + 7$ **(b)** $m^2 - 1$

19. **(a)** $3a^2 + 2ab - b^2$ **(b)** $3a^3 - 6a^2 + 7a$

20. **(a)** $a^2b - ab^2 - 4b^3$ **(b)** $2 + b - 3b^2$

21. **(a)** $2x^2 - 7x - 1$ **(b)** 8

22. **(a)** $a^2 + 2a - 1$ **(b)** 16

23. **(a)** $x^2 + 3x + 4$ **(b)** yes

Exercise 12D

Level 1

1. **(a)** $2a + 6$ **b)** $6b - 30$

2. **(a)** $12c + 4$ **(b)** $21 - 6d$

3. **(a)** $-14e - 7$ **(b)** $-16f + 6$

4. **(a)** $4x - 4y$ **(b)** $-5x + 10y$

5. **(a)** $7rs - 2rt$ **(b)** $6ab - 10ac$

6. **(a)** $3g^2 + 2g$ **(b)** $5j^2 - 4j$

7. **(a)** $-15x + 18x^2$ **(b)** $20y^2 + 4y$

8. **(a)** $5h^3 - 15h^2$ **(b)** $-2m^3 + 8m^2$

9. **(a)** $-2x + 2y - 2$ **(b)** $4h + 4k - 12$

10. **(a)** $-3x^2 - 6xy + 12xz$

(b) $2pr - 6r^2 + 10qr$

11. **(a)** $18t^3 - 12t^2 + 6t$ **(b)** $-28s^3 + 7s^2 - 21s$

12. **(a)** $c^2 + 4c + 3$ **(b)** $f^2 - 10f + 9$

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

14. **(a)** $8 - 34t + 21t^2$ **(b)** $10 + 17w - 20w^2$

15. **(a)** $8m^2 - 2m - 45$ **(b)** $-18n^2 + 15n - 2$

16. **(a)** $2x^2 + 3xy + y^2$ **(b)** $3h^2 - 4hk + k^2$

17. **(a)** $m^2 - n^2$ **(b)** $4p^2 - q^2$

18. **(a)** $8a^2 - 2ab - 15b^2$ **(b)** $28x^2 - 29xy + 6y^2$

19. **(a)** $s^2 + 8s + 16$ **(b)** $4c^2 - 12c + 9$

20. **(a)** $h^2 - 6hk + 9k^2$ **(b)** $36x^2 + 60xy + 25y^2$

21. **(a)** $8a^2 + 2a - 15$ **(b)** $2d^2 - 23d + 56$

22. **(a)** $6p^2 + 11pq + 4q^2$ **(b)** $-42x^2 + 26xy - 4y^2$

23. **(a)** $2m^3 - 5m^2 - 7m - 20$

(b) $3h^4 - 4h^3 - 19h^2 + 24h + 6$

Level 2

24. **(a)** $5a + 5$ **(b)** $4c - 16$

25. **(a)** $b + 4$ **(b)** $-13d + 22$

26. **(a)** $2e^2 - 5e$ **(b)** $5f^2 - 14f$

27. **(a)** $-8 + 3a + a$ **(b)** $-15 - 11x + 2x^2$

28. **(a)** $49 - 28a + 6a^2$ **(b)** $39 - 8x + 9x^2$

29. **(a)** $-2a^3b - 4a^2b^2 + ab^3$

(b) $16xy^2z - 8y^3z - 12x^2yz$

30. **(a)** $g^3 + 2g^2 - 2g + 3$

(b) $-4p^3 - 7p^2 - 5p - 2$

31. **(a)** $-12h^3 - 16h^2 + 60h$

(b) $6r^3 + 10r^2t + 4rt^2$

32. $(2x^2 + 45x - 7)$

33. **(a)** $(x + 2y)$ cm **(b)** $(x^2 + 4xy + 4y^2)$ cm^2

34. **(a)** $(3a^2 + 15a + 19)$

(b) no

Exercise 12E

Level 1

1. D **2.** C **3.** B **4.** A

5. D **6.** C **7.** A **8.** D

9. B **10.** C

Level 2

11. B **12.** D **13.** C **14.** B

15. B **16.** A

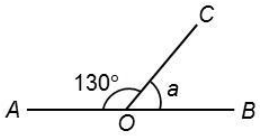
English Version

S1 Summer Exercise – Angles in Rectilinear Figure
Angles related to Intersecting Lines

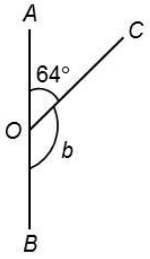
Level 1

In each of the following figures, *AOB* is a straight line. Find the unknown. **(1 – 6)**

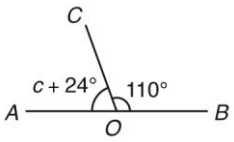
1.



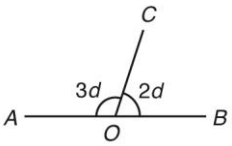
2.



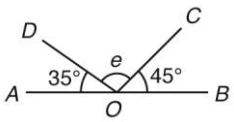
3.



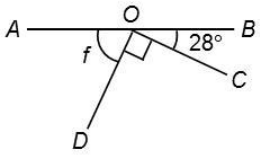
4.



5.

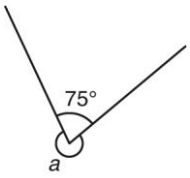


6.

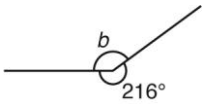


Find the unknown in each of the following figures. **(7 – 12)**

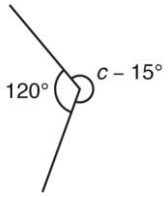
7.



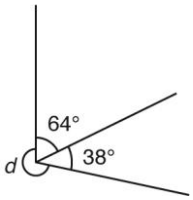
8.



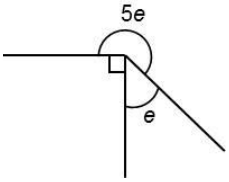
9.



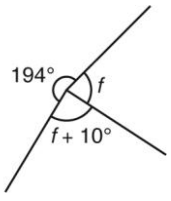
10.



11.

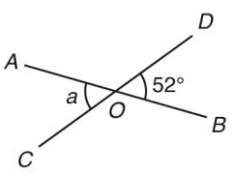


12.

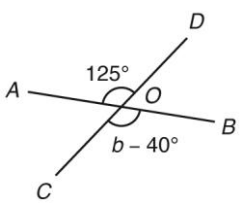


In each of the following figures, *AB* and *CD* intersect at *O*. Find the unknown. **(13 – 18)**

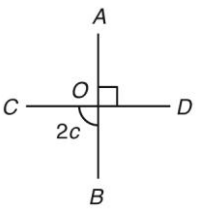
13.



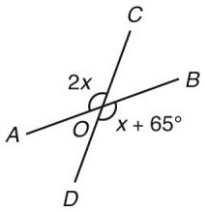
14.



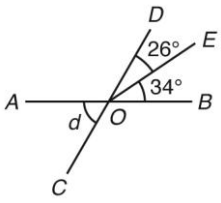
15.



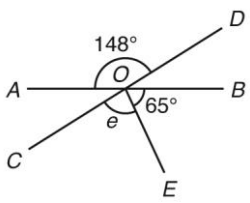
16.



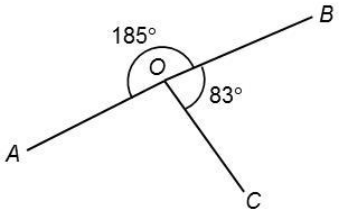
17.



18.



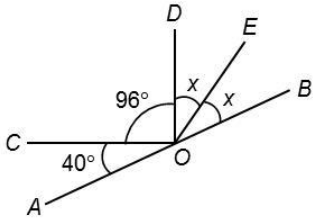
19. Refer to the figure on the right.
Is $\angle AOC$ a right angle? Explain your answer.



Level 2

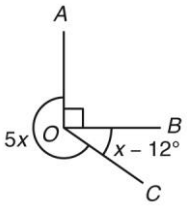
Find the unknown(s) in each of the following figures. **(20 – 22)**

20.

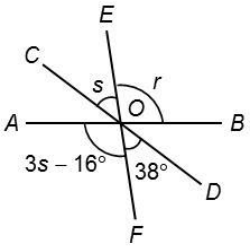


AOB is a straight line.

21.

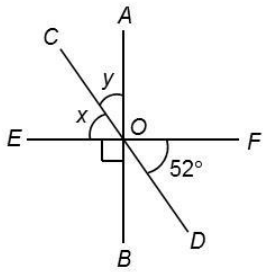


22.

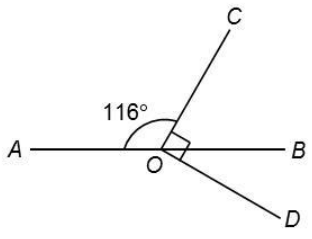


AOB, *COD* and *EOF* are straight lines.

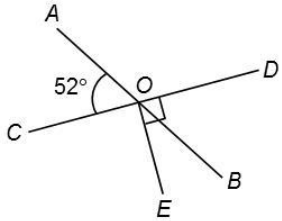
23. In the figure, *AOB*, *COD* and *EOF* are straight lines. Find x and y.



24. In the figure, *AOB* is a straight line. Find $\angle BOD$.

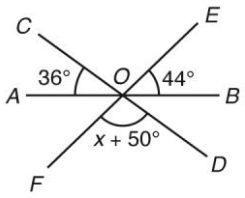


25. In the figure, *AB* and *CD* intersect at *O*. Find $\angle BOE$.



26. In the figure, *AOB*, *COD* and *EOF* are straight lines. Find *x*.

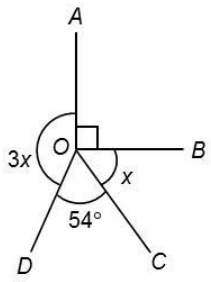
50°



27. Refer to the figure on the right.

(a) Find *x*.

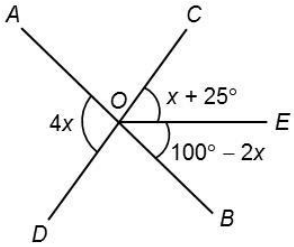
(b) Does *OC* bisect $\angle BOD$? Explain your answer.



28. In the figure, *AOB* and *COD* are straight lines.

(a) Find *x*.

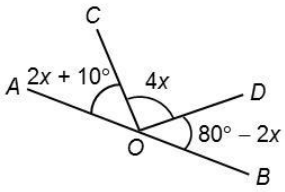
(b) Does *OE* bisect $\angle COB$? Explain your answer.



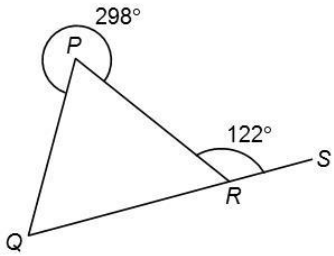
29. In the figure, *AOB* is a straight line.

(a) Find *x*.

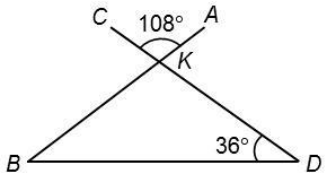
(b) Is $OC \perp OD$? Explain your answer.



30. In the figure, *QRS* is a straight line. Find $\angle PQR$.



31. In the figure, *AB* and *CD* intersect at *K*. Timothy claims that reflex $\angle KBD$ is three times $\angle AKC$. Do you agree? Explain your answer.

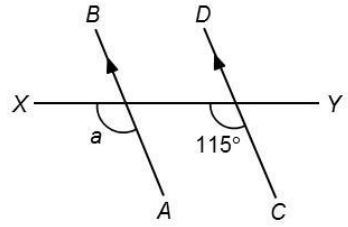


Angles related to Parallel Lines

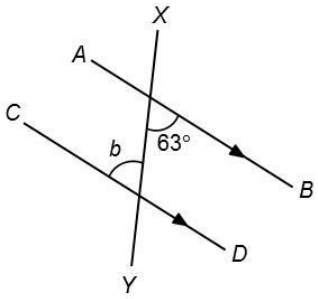
Level 1

In each of the following figures, *AB* // *CD* and *XY* is a straight line. Find the unknown(s). **(1 – 6)**

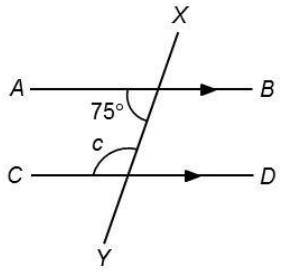
1.



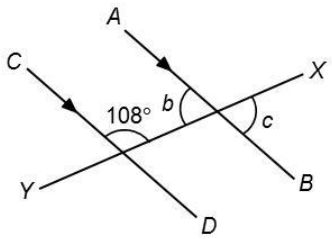
2.



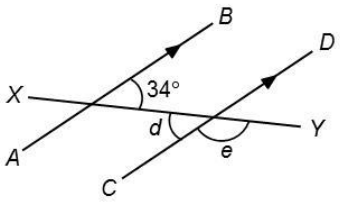
3.



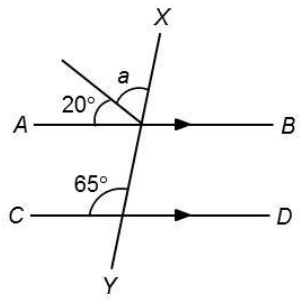
4.



5.

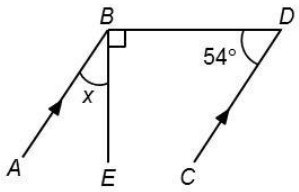


6.

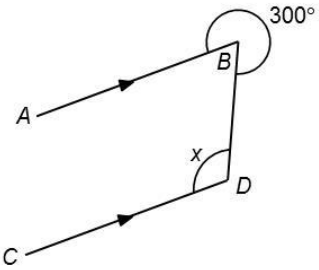


Find the unknown(s) in each of the following figures. **(7 – 15)**

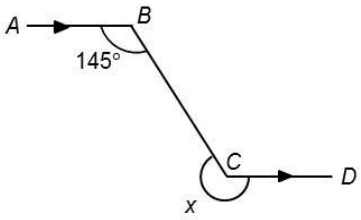
7.



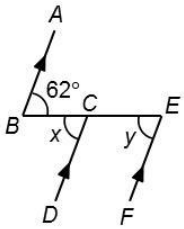
8.



9.

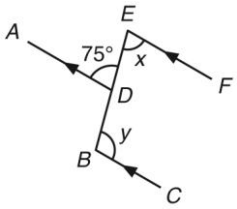


10.



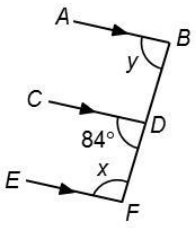
BCE is a straight line.

11.



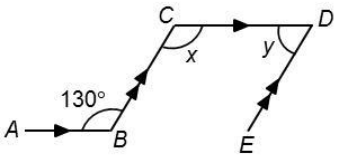
BDE is a straight line.

12.

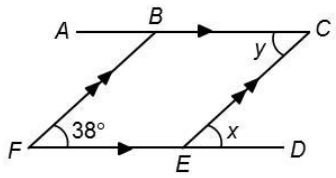


BDF is a straight line.

13.

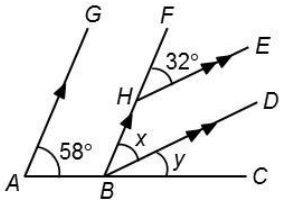


14.



ABC and *FED* are straight lines.

15.

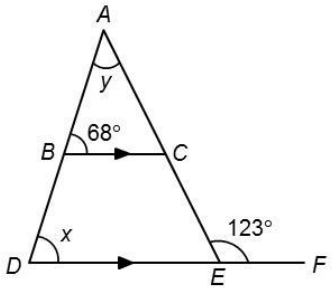


ABC and *BHF* are straight lines.

Level 2

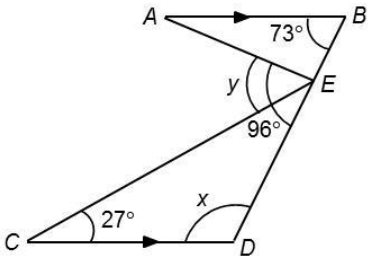
Find the unknowns in each of the following figures. **(16 – 23)**

16.



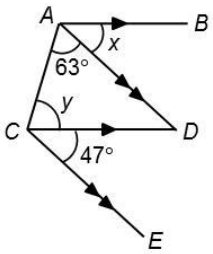
ABD, *ACE* and *DEF* are straight lines.

17.

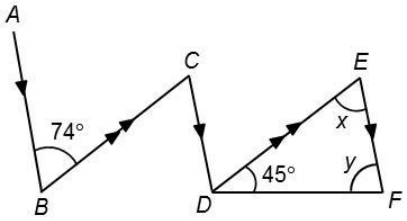


BED is a straight line.

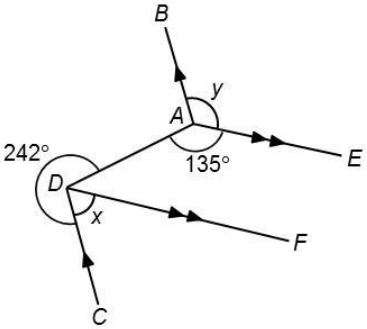
18.



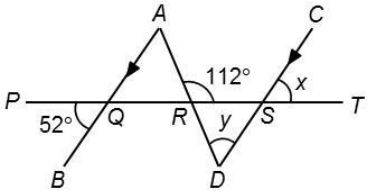
19.



20.

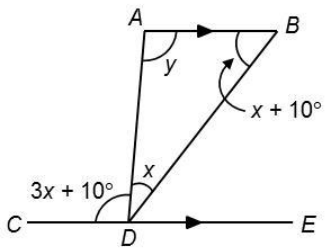


21.



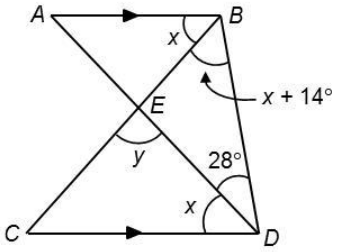
AQB, *ARD*, *CSD* and *PQRST* are straight lines.

22.



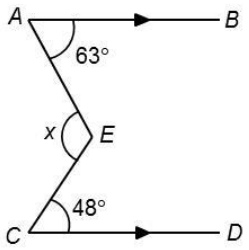
CDE is a straight line.

23.

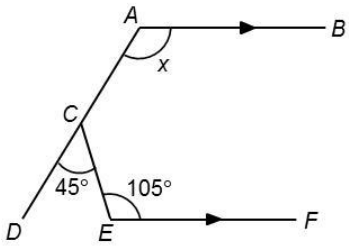


AED and *BEC* are straight lines.

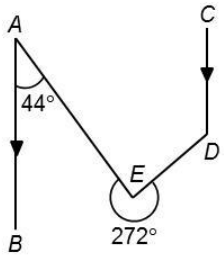
24. In the figure, *AB* // *CD*. $\angle BAE = 63°$ and $\angle ECD = 48°$. Find *x*.



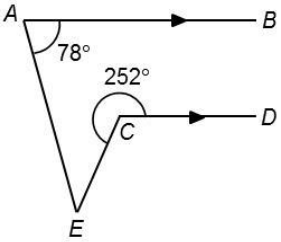
25. In the figure, *ACD* is a straight line. *AB* // *EF*, $\angle CEF = 105°$ and $\angle DCE = 45°$. Find *x*.



26. In the figure, *AB* // *CD*. $\angle BAE = 44°$ and reflex $\angle AED = 272°$. Find $\angle EDC$.



27. In the figure, *AB* // *CD*. $\angle BAE = 78°$ and reflex $\angle DCE = 252°$. Find $\angle AEC$.

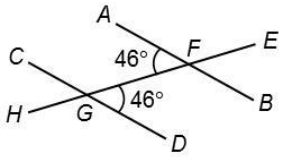


Identifying Parallel Lines

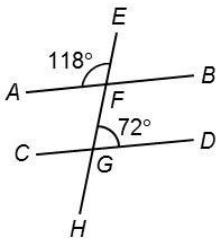
Level 1

In each of the following figures, *EH* intersects *AB* and *CD* at *F* and *G* respectively. Determine whether *AB* is parallel to *CD*. If yes, state the reason. **(1 - 3)**

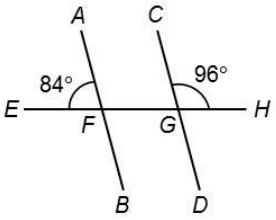
1.



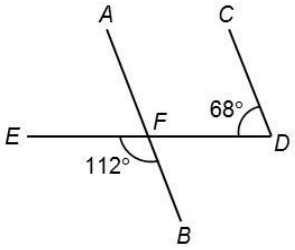
2.



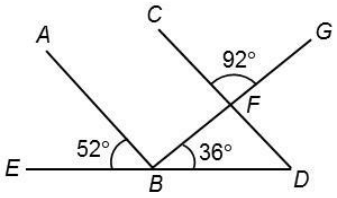
3.



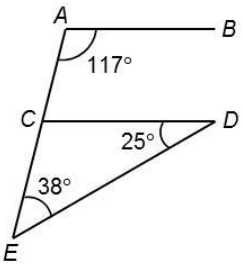
4. In the figure, *AFB* and *EFD* are straight lines. $\angle EFB = 112°$ and $\angle CDF = 68°$. Is *AB* // *CD*? If yes, give a reason.



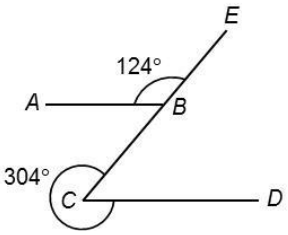
5. In the figure, *EBD*, *BFG* and *CFD* are straight lines. $\angle ABE = 52°$, $\angle FBD = 36°$ and $\angle CFG = 92°$. Is *AB* parallel to *CD*? If yes, give a reason.



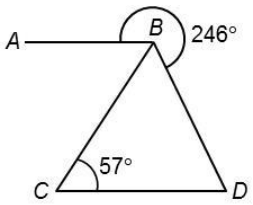
6. In the figure, *ACE* is a straight line. $\angle BAC = 117°$, $\angle CED = 38°$ and $\angle CDE = 25°$. Determine whether *AB* is parallel to *CD* and give a reason.



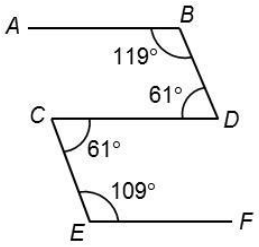
7. In the figure, *EBC* is a straight line. $\angle ABE = 124°$ and reflex $\angle BCD = 304°$. Is *AB* // *CD*? If yes, give a reason.



8. In the figure, BC bisects $\angle ABD$. Reflex $\angle ABD = 246°$ and $\angle BCD = 57°$. Determine whether AB is parallel to CD and give a reason.

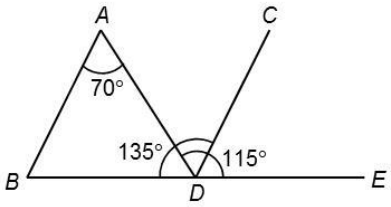


9. Refer to the figure on the right. Write down all the pairs of parallel lines and give a reason for each pair of parallel lines.

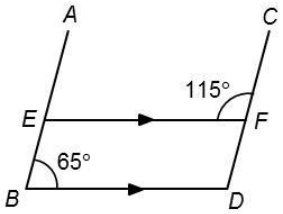


Level 2

10. In the figure, BDE is a straight line. $\angle BAD = 70°$, $\angle BDC = 135°$ and $\angle ADE = 115°$. Is AB parallel to CD? If yes, give a reason.



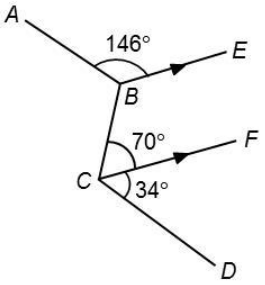
11. In the figure, AEB and CFD are straight lines. EF // BD, $\angle ABD = 65°$ and $\angle CFE = 115°$. Is AB parallel to CD? If yes, give a reason.



12. In the figure, BE // CF. $\angle ABE = 146°$, $\angle BCF = 70°$ and $\angle FCD = 34°$.

(a) Find $\angle ABC$.

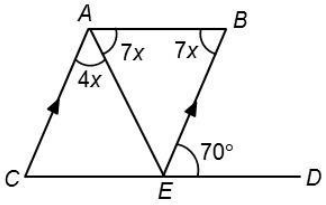
(b) Determine whether AB is parallel to CD and give a reason.



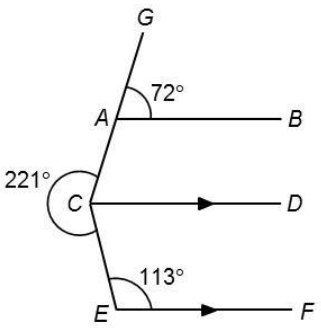
13. In the figure, *CED* is a straight line, *CA* // *EB* and $\angle BED = 70°$.

(a) Find *x*.

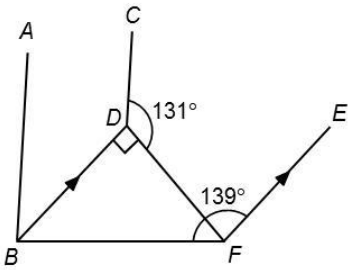
(b) Determine whether *AB* is parallel to *CD* and give a reason.



14. In the figure, *GAC* is a straight line. *CD* // *EF*, $\angle GAB = 72°$, $\angle CEF = 113°$ and reflex $\angle ACE = 221°$. Is *AB* // *CD*? If yes, give a reason.



15. In the figure, *BD* bisects $\angle ABF$. *BD* // *FE*, $\angle BDF = 90°$, $\angle CDF = 131°$ and $\angle BFE = 139°$. Determine whether *AB* is parallel to *CD* and give a reason.

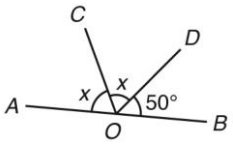


Multiple Choice Questions

Level 1

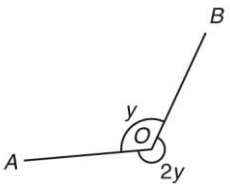
1. In the figure, *AOB* is a straight line. Find *x*.

A. 25°
B. 50°
C. 65°
D. 130°



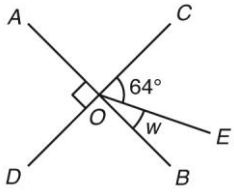
2. Find *y* in the figure.

A. 60°
B. 100°
C. 120°
D. 150°



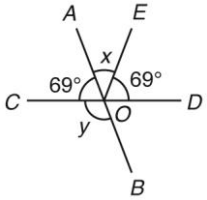
3. In the figure, *AOB* and *COD* are straight lines. Find *w*.

A. 26°
B. 30°
C. 32°
D. 36°



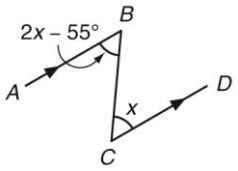
4. In the figure, *AOB* and *COD* are straight lines. Find *x* and *y*.

A. $x = 42°, y = 69°$
B. $x = 42°, y = 111°$
C. $x = 69°, y = 69°$
D. $x = 69°, y = 138°$



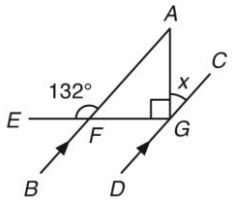
5. Find *x* in the figure.

A. 37°
B. 43°
C. 49°
D. 55°



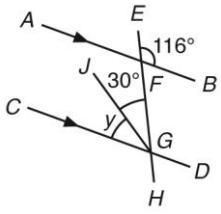
6. In the figure, *AFB*, *CGD* and *EFG* are straight lines. Find *x*.

A. 42°
B. 48°
C. 52°
D. 58°



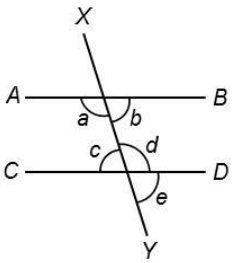
7. In the figure, *EH* intersects *AB* and *CD* at *F* and *G* respectively. Find *y*.

A. 34°
B. 56°
C. 64°
D. 86°



8. Which of the following CANNOT be a condition for proving *AB* // *CD*?

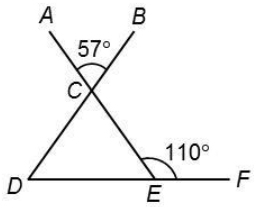
A. $a = d$
B. $b = e$
C. $a + b = 180°$
D. $a + c = 180°$



Level 2

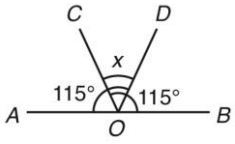
9. In the figure, *ACE*, *BCD* and *DEF* are straight lines. Find $\angle CDE$.

A. 50°
B. 53°
C. 56°
D. 59°



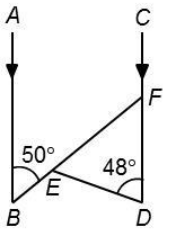
10. In the figure, *AOB* is a straight line. Find *x*.

A. 50°
B. 57.5°
C. 60°
D. 67.5°



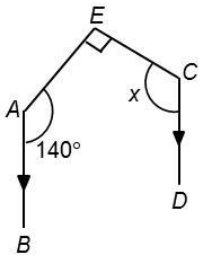
11. In the figure, *BEF* and *CFD* are straight lines. Find $\angle BED$.

A. 82°
B. 96°
C. 98°
D. 100°



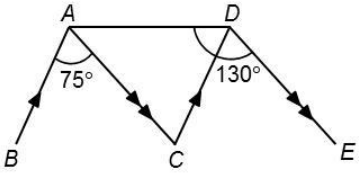
12. Find *x* in the figure.

A. 120°
B. 130°
C. 140°
D. 150°



13. In the figure, $\angle ADE = 130°$ and $\angle BAC = 75°$. Find $\angle ADC$.

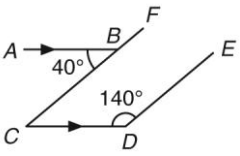
A. 50°
B. 55°
C. 60°
D. 65°



14. In the figure, *FBC* is a straight line. Which of the following must be correct?

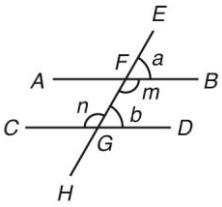
I. $\angle BCD = 40°$
II. $\angle ABF = 140°$
III. *FC* // *ED*

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



15. In the figure, *EH* intersects *AB* and *CD* at *F* and *G* respectively. If $a = b$, which of the following must be correct?

A. $a = m$
B. $b = n$
C. $m = b$
D. $m = n$



Answers

Exercise 11A

Level 1

1. 50° **2.** 116°
3. 46° **4.** 36°
5. 100° **6.** 62°
7. 285° **8.** 144°
9. 255° **10.** 258°
11. 45° **12.** 78°
13. 52° **14.** 165°
15. 45° **16.** 65°
17. 60° **18.** 83°
19. no

Level 2

20. 22° **21.** 47°
22. $s = 38°$, $r = 98°$ **23.** $x = 52°$, $y = 38°$
24. 26° **25.** 38°
26. 50°
27. **(a)** 54° **(b)** yes
28. **(a)** 25° **(b)** yes
29. **(a)** 22.5° **(b)** yes
30. 60° **31.** yes

Exercise 11B

Level 1

1. 115° **2.** 63°
3. 105° **4.** $b = 72°$, $c = 72°$
5. $d = 34°$, $e = 146°$ **6.** 45°
7. 36° **8.** 120°
9. 215° **10.** $x = 62°$, $y = 62°$
11. $x = 75°$, $y = 105°$ **12.** $x = 96°$, $y = 84°$
13. $x = 130°$, $y = 50°$ **14.** $x = 38°$, $y = 38°$
15. $x = 32°$, $y = 26°$

Level 2

16. $x = 68°$, $y = 55°$ **17.** $x = 107°$, $y = 50°$
18. $x = 47°$, $y = 70°$ **19.** $x = 74°$, $y = 61°$
20. $x = 73°$, $y = 107°$ **21.** $x = 52°$, $y = 60°$
22. $x = 32°$, $y = 106°$ **23.** $x = 46°$, $y = 88°$
24. 111° **25.** 120°
26. 136° **27.** 30°

Exercise 11C

Level 1

1. yes, alt. ∠s equal
2. no
3. yes, corr. ∠s equal (or int. ∠s supp.)
4. yes, int. ∠s supp. (or corr. ∠s equal or alt. ∠s equal)
5. yes, corr. ∠s equal
6. yes, corr. ∠s equal
7. yes, alt. ∠s equal
8. yes, alt. ∠s equal
9. *AB* // *CD*, int. ∠s supp.
BD // *CE*, alt. ∠s equal

Level 2

10. yes, alt. ∠s equal (or int. ∠s supp.)
11. yes, int. ∠s supp.
12. **(a)** 104° **(b)** yes, alt. ∠s equal
13. **(a)** 10° **(b)** yes, alt. ∠s equal
14. yes, corr. ∠s equal
15. yes, int. ∠s supp.

Exercise 11D

Level 1

1. C **2.** C **3.** A **4.** B
5. D **6.** A **7.** A **8.** C

Level 2

9. B **10.** A **11.** C **12.** B
13. B **14.** D **15.** D