

## Chapter 5 Exercise 5.1

Q. 6. (i)  $8x + 10x + 20 = 180$

$$18x = 160$$

$$x = 8\frac{8}{9}$$

(ii)  $6x + 4 = 90$

$$6x = 86$$

$$x = \frac{43}{3}$$

(iii)  $11x - 7 + 15x + 5 = 180^\circ$

$$26x - 2 = 180$$

$$26x = 182$$

$$x = 7$$

(iv)  $5x + 11x - 12 = 180$

$$16x = 192$$

$$x = 12$$

(v)  $5x - 15 + 3x + 5 + x + 5 + 50 = 180$

$$9x + 45 = 180$$

$$9x = 135$$

$$x = 15$$

(vi)  $8x - 8 = 5x + 10$

$$3x = 18$$

$$x = 6$$

## Exercise 5.2

Q. 3. (i)  $A = 55^\circ$  corresponding

$B = 125^\circ$  supplementary

(ii)  $A = 40^\circ$  alternate

$B = 40^\circ$  alternate

$C = 110^\circ$  corresponding

$D = 70^\circ$  supplementary

(iii)  $A = 110^\circ$

$B = 110^\circ$

$C = 70^\circ$

(iv)  $B = 55^\circ$

$$A = 360^\circ - 260^\circ - 55^\circ = 45^\circ$$

$$C = 135^\circ$$

(v)  $A = 180^\circ - 50^\circ - 25^\circ = 105^\circ$

$$B = 50^\circ$$

$$C = 50^\circ$$

(vi)  $A = 180^\circ - 113^\circ = 67^\circ$

$$B = 67^\circ$$

$$C = 53^\circ$$

(vii)  $A = 100^\circ$

Q. 4. (i)  $x + y + 5x - y = 180^\circ$

$$6x = 180^\circ$$

$$x = 30^\circ$$

$$x + y = 2x + y - 30$$

$$30 + y = 2(30) + y - 30$$

$$30 + y = 30 + y$$

$$0^\circ \leq y < 150^\circ$$

(ii)  $20x - 2y + 1 = 12x + 4y + 9$

$$8x - 6y - 8 = 0 \dots\dots\dots \textcircled{1}$$

$$20x - 2y + 1 + 4x + 6y - 11 = 180$$

$$24x + 4y - 190 = 0 \dots\dots\dots \textcircled{2}$$

$$\ominus 24x \oplus 18y \oplus 24 = 0 \dots\dots \textcircled{1} \times 3$$

$$22y - 166 = 0$$

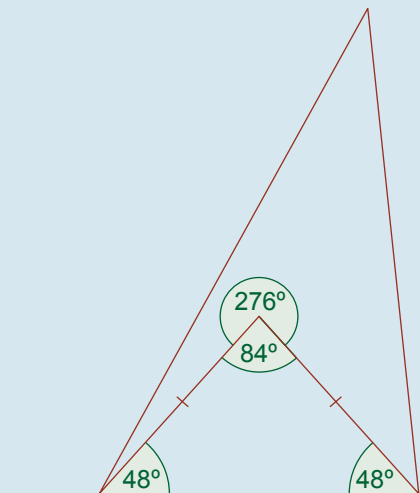
$$y = 7\frac{6}{11} = \frac{83}{11}$$

$$8x - 6\left(\frac{83}{11}\right) - 8 = 0$$

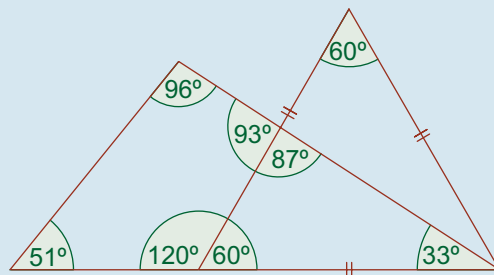
$$x = \frac{293}{44}$$

### Exercise 5.3

- Q. 1. (i)  $A = 114^\circ - 63^\circ$   
 $= 51^\circ$   
 $B = 180^\circ - 114^\circ$   
 $= 66^\circ$
- (ii)  $B = 60^\circ$   
 $C = 60^\circ$   
 $A = 75^\circ$
- (iii)  $A = 30^\circ$   
 $B = 108^\circ - 2(30^\circ) = 120^\circ$   
 $C = 150^\circ$
- (iv)  $C = \frac{180 - 77}{2} = 51.5^\circ$   
 $A = B = 64.25^\circ$
- (v)  $A = C$   
 $54 + B + 63 = 180$   
 $B = 180 - 117$   
 $B = 63^\circ$   
 $B + C + 63^\circ = 180^\circ$   
 $63 + C + 63^\circ = 180^\circ$   
 $C = 54^\circ$   
 $\therefore A = 54^\circ$
- (vii)  $118 = 32 + 38 + A$   
 $A = 48^\circ$   
 $B = 360^\circ - 276 - 38 - 32$   
 $= 14^\circ$



- (viii)  $C = 180^\circ - 60^\circ = 120^\circ$   
 $A = 93^\circ$   
 $B = 360^\circ - 51^\circ - 120^\circ - 93^\circ$   
 $= 96^\circ$



- Q. 2. (i)  $5x = 180^\circ$   
 $x = 36^\circ$
- (ii)  $2x + 1 = 133^\circ$   
 $2x = 132^\circ$   
 $x = 66^\circ$   
 $y = 180^\circ - 133^\circ$   
 $= 47^\circ$
- (iii)  $2x = x + y + 4y + 4$   
 $x = 5y + 4$   
 $x - 5y - 4 = 0 \dots\dots\dots ①$   
 $2x + 6y - 4 = 180$   
 $2x + 6y - 184 = 0$   
 $x + 3y - 92 = 0 \dots\dots\dots ②$   
 $\ominus x \oplus 5y \oplus 4 = 0 \dots\dots\dots ①$   
 $\hline 8y - 88 = 0$   
 $y = 11$   
 $x - 5(11) - 4 = 0$   
 $x = 59$

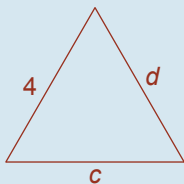
- Q. 3. Students required to use theorem:  
 External angle = sum of two interior  
 opposite angles.

### Exercise 5.4

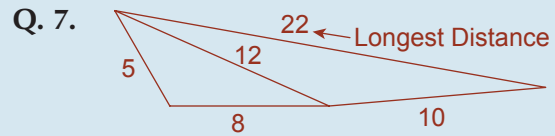
Relevant congruency proof.

## Exercise 5.5

- |       | Smallest                 | Largest      |
|-------|--------------------------|--------------|
| Q. 1. | (i) C                    | B            |
|       | (ii) F                   | E            |
|       | (iii) $\angle HIG$       | $\angle GHI$ |
|       | (iv) K                   | L            |
|       | (v) R                    | Q            |
| Q. 2. | (i) No                   | (iv) No      |
|       | (ii) Yes                 | (v) Yes      |
|       | (iii) Yes                | (vi) Yes     |
| Q. 3. | (i) 7                    |              |
|       | (ii) 13                  |              |
|       | (iii) $7 \leq n \leq 13$ |              |
| Q. 4. | (i) $a = 9$              |              |
|       | (ii) $a = 14$            |              |
|       | (iii) $9 \leq a \leq 14$ |              |
| Q. 5. | (i) $b = 9$              |              |
|       | (ii) $b = 16$            |              |
|       | (iii) $9 \leq b \leq 16$ |              |
| Q. 6. |                          |              |



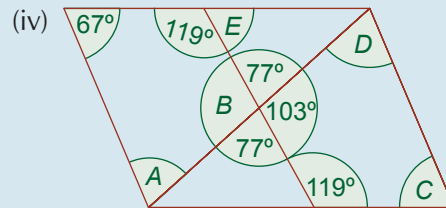
- (i) 2, 3, 4 gives  $28.96^\circ$   $46.57^\circ$   $104.48^\circ$   
 2, 5, 4 gives  $22.3^\circ$   $108.21^\circ$   $49.64^\circ$   
 3, 4, 5 gives  $90^\circ$   $36.87^\circ$   $53.13^\circ$   
 3, 4, 6 gives  $26.38^\circ$   $117.28^\circ$   $36.34^\circ$   
 4, 5, 6 gives  $82.82^\circ$   $55.78^\circ$   $41.4^\circ$
- (ii) Triangle 2, 5, 4 gives the smallest angle ( $22.3^\circ$ ).
- (iii) Triangle 3, 4, 6 gives the largest angle ( $117.28^\circ$ ).



$\therefore 22$  is possible  
 Shortest distance is 1.  
 $1 \leq c \leq 22$

## Exercise 5.6

- Q. 1. (i)  $B = 49^\circ$  alt  
 $C = 90^\circ$  opp  
 $A = 90^\circ - 49^\circ = 41^\circ$
- (ii)  $A = 90^\circ$   
 $B = \frac{180^\circ - 75^\circ}{2} = 52.5^\circ$   
 $C = 180 - 52.5 - 90 = 37.5^\circ$
- (iii)  $A = 40^\circ$   
 $B = 80^\circ$   
 $C = 60^\circ$



- $B = 180 - 77 = 103$   
 $A = 360 - 67 - 119 - 103$   
 $= 71^\circ$   
 $D = 71^\circ$   
 $C = 67^\circ$   
 $E = 61^\circ$
- (v)  $D = 180^\circ - 80^\circ - 30^\circ = 70^\circ$   
 $D = 70^\circ$   
 $A + D = 130^\circ$   
 $A = 130^\circ - 70^\circ$   
 $A = 60^\circ$   
 $C = 180^\circ - 80^\circ - 70^\circ = 30^\circ$   
 $C = 30^\circ$   
 $D + B = A + 70^\circ$   
 $B = A$   
 $B = 60^\circ$

**Q. 2.** (i)  $4x + y = 3y + 2$   
 $4x - 2y = 2$  ..... ①  
 $6x + y = 10 - 2y + 1$   
 $6x - y = 11$  ..... ②  
 $4x - 2y = 2$  ..... ①  
 $\ominus 12x \oplus 2y = \ominus 22$  ..... ②  $\times 2$   
 $\hline -10x = -20$

$x = 2$

$4(2) - 2y = 2$   
 $-2y = -6$

$y = 3$

(ii)  $16x - 10y = 82^\circ$  ..... ①  
 $8x + 14y + 16x - 10y = 180^\circ$   
 $24x + 4y = 180^\circ$  ..... ②  
 $24x - 15y = 123$  ..... ①  $\times \frac{3}{2}$   
 $\ominus 24x + 4y = \ominus 180$  ..... ②  
 $\hline -19y = -57$

$y = 3$

$16x - 10(3) = 82$   
 $16x = 112$

$x = 7$

**Q. 3.** (i) Students use SAS

(ii) Use congruency

**Q. 4.** Proof

**Q. 5.** (i) Isosceles

(ii) Theorem 9

(iii) Yes SAS

(iv) Proof

**Q. 6.** Proof

### Exercise 5.7

**Q. 1.** (i)  $4x - 2 = 2x + 4$

$2x = 6$

$x = 3$

$y = 8$

(ii)  $2x + 3 = 6x - 1$

$4x = 4$

$x = 1$

$2y + 1 = 4y - 6$

$2y = 7$

$y = \frac{7}{2}$

(iii)  $2(4y + 2) = 12$

$8y + 4 = 12$

$8y = 8$

$y = 1$

$3(2x + 1) = 15$

$2x + 1 = 5$

$2x = 4$

$x = 2$

**Q. 2.** (i)  $\frac{|AQ|}{|QC|} = \frac{2}{5}$

(ii)  $\frac{|AP|}{|AB|} = \frac{1}{4}$

(iii)  $\frac{|AB|}{|AP|} = \frac{4}{1}$

(iv)  $\frac{|AP|}{|AB|} = \frac{3}{7}$

**Q. 3.** (i)  $\frac{7}{3} = \frac{x}{4}$

$3x = 28$

$x = \frac{28}{3}$

(ii)  $\frac{x}{30} = \frac{30}{40}$

$x = \frac{900}{40}$

$x = 22.5$

(iii)  $\frac{x}{x+8} = \frac{12}{24}$

$\frac{x}{x+8} = \frac{1}{2}$

$2x = x + 8$

$x = 8$

(iv)  $\frac{x}{4.2} = \frac{10.2 + 5.6}{5.6}$

$x = 11.85$

**Q. 4.** (i)  $\frac{3}{y+3} = \frac{3.6}{4.8}$   
 $\frac{15}{5y+15} = \frac{18}{24}$   
 $360 = 90y + 270$

$90 = 90y$

$y = 1$

(ii)  $\frac{y+9}{4} = \frac{19.6}{5.6}$   
 $5.6y + 50.4 = 78.4$

$5.6y = 28$

$y = 5$

(iii)  $\frac{y-2}{12} = \frac{4}{y}$   
 $y(y-2) = 48$

$y^2 - 2y - 48 = 0$

$(y-8)(y+6) = 0$

$y = 8$       $y = -6$

reject

(iv)  $\frac{4y-3}{2y+1} = \frac{5y}{4y+4}$

$(4y-3)(4y+4) = 5y(2y+1)$

$16y^2 + 16y - 12y - 12 = 10y^2 + 5y$

$6y^2 - y - 12 = 0$

$(3y+4)(2y-3) = 0$

$y = \frac{-4}{3}$

$y = \frac{3}{2}$

reject

**Q. 5.** (i) 3 : 5

(ii) 3 : 2

(iii) 5 : 2

**Q. 6.** (i)  $\frac{3}{7}$

(ii)  $\frac{3}{7}$

(iii)  $\frac{7}{4}$

**Q. 7.** Is  $\frac{9}{7.5} = \frac{9.5}{8}$  ?

$72 \neq 71.25$

$\therefore XY \not\parallel PR$

**Q. 8.** Is  $\frac{9}{15} = \frac{10}{14}$

$90 \neq 90$

$\Rightarrow AB \not\parallel DE$

**Q. 9.** (i)  $\frac{12}{9} = \frac{6.5+x}{2.6+x}$      Let  $|BD| = x$

$12(2.6+x) = 9(6.5+x)$

$31.2 + 12x = 58.5 + 9x$

$3x = 27.3$

$x = 9.1$

$|BD| = 9.1$

(ii)  $|AC| = 9 - y$      Let  $|CQ| = y$

$\frac{9-y}{12} = \frac{9.1}{9.1+6.5}$

$\frac{9-y}{12} = \frac{9.1}{15.6}$

$15.6(9-y) = 12(9.1)$

$140.4 - 15.6y = 109.2$

$31.2 = 15.6y$

$y = 2$

$|AC| = 9 - 2 = 7$

$|AC| = 7$

(iii)  $|CQ| = 2$

**Q. 10.** (i)  $\frac{|BZ|}{|YZ|} = \frac{11.65}{11.65 + 10.35}$

$\frac{|BZ|}{30.8} = \frac{11.65}{22}$

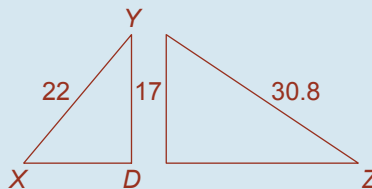
$|BZ| = 16.31$

(ii)  $\frac{|YC|}{9} = \frac{10.35}{11.65}$

$|YC| = \frac{9(10.35)}{11.65}$

$|YC| \approx 8$

(iii)



$|XD| = \sqrt{22^2 - 17^2}$

$|DZ| = \sqrt{30.8^2 - 17^2}$

$|XZ| = \sqrt{195} + \sqrt{659.64}$

$\text{Ans} = 39.65$

## Revision Exercises

- Q. 1.** (a) (i)  $117^\circ$   
 (ii)  $117^\circ$   
 (iii)  $63^\circ$   
 (iv)  $117^\circ$   
 (v)  $63^\circ$   
 (vi)  $63^\circ$   
 (vii)  $63^\circ$   
 (viii)  $117^\circ$

- (b) (i)  $112^\circ$   
 (ii)  $68^\circ$   
 (iii)  $34^\circ$   
 (iv)  $34^\circ$   
 (v)  $56^\circ$   
 (vi)  $90^\circ$   
 (vii)  $90^\circ$   
 (viii)  $112^\circ$

- Q. 2.** (a) (i)  $|\angle 2| = 70^\circ$   
 (ii)  $|\angle 4| = 110^\circ$   
 (iii)  $|\angle 5| = 70^\circ$   
 (iv)  $|\angle 6| = 110^\circ$

(b)  $7x + 10 = 8x - 5$

$$x = 15^\circ$$

$$|\angle 4| = 7(15) + 10 = 115^\circ$$

$$|\angle 8| = 8(15) - 5 = 115^\circ$$

- Q. 3.** (a) (i)  $5x + 5y + 15x + 7y = 180^\circ$   
 $20x + 12y = 180^\circ \dots\dots ①$

$$2(10x + 2y) + 5x + 5y = 180^\circ$$

$$20x + 4y + 5x + 5y = 180^\circ$$

$$25x + 9y = 180^\circ \dots\dots ②$$

$$① \div 4 \quad 5x + 3y = 45$$

$$\begin{array}{r} \phantom{25x + 9y = 180^\circ} \\ \phantom{25x + 9y = 180^\circ} \quad \ominus \\ \phantom{25x + 9y = 180^\circ} \times 3 \quad \ominus 15x + 9y = \ominus 135 \end{array}$$

$$② \quad \underline{25x + 9y = 180}$$

$$10x = 45$$

$$x = 4.5$$

$$5(4.5) + 3y = 45$$

$$3y = 22.5$$

$$y = 7.5$$

(ii)  $|\angle 2| = 10(4.5) + 2(7.5)$   
 $= 45 + 15$   
 $= 60^\circ$

$$|\angle 3| = 60^\circ$$

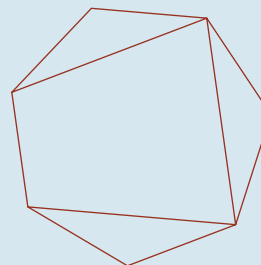
$$|\angle 5| = 5(4.5) + 5(7.5)$$
  
 $= 22.5 + 37.5$   
 $= 60^\circ$

$$|\angle 6| = 180^\circ - 60^\circ$$
  
 $= 120^\circ$

$$|\angle 1| = 180^\circ - 60^\circ = 120^\circ$$

$$|\angle 4| = 180^\circ - 60^\circ = 120^\circ$$

- Q. 3.** (b) (ii)



A seven-sided polygon can be divided into three triangles and one quadrilateral.

$$\Rightarrow 3 \times 180^\circ + 360^\circ$$
  
 $= 900^\circ$

- (iii) Seven such angles

$$\Rightarrow A = \frac{900}{7} \approx 129^\circ$$

- (c) If you have an eight-sided polygon of equal side lengths:

The shape can be divided into six triangles:

$$\Rightarrow \text{There are } 6(180^\circ) = 1,080^\circ \text{ in the shape.}$$

There are eight vertices (equal in measure):

$$\Rightarrow \text{Each vertex is } \frac{1,080^\circ}{8} = 135^\circ.$$

In general, an  $n$ -sided polygon can be divided into  $n - 2$  triangles.

Total number of degrees =  $(n - 2)$  ( $180^\circ$ ).

$n$  vertices  $\Rightarrow$  Measure of each vertex =  $\frac{(n-2)180^\circ}{n}$

- Q. 4.** (a) (i)  $72^\circ$   
 (ii)  $114^\circ$   
 (iii)  $39^\circ$   
 (iv)  $27^\circ$

(b) (i)  $4x + 2y + 2 = 7x + \frac{3}{2}y$   
 $8x + 4y + 4 = 14x + 3y$   
 $6x - y - 4 = 0 \dots\dots\dots \textcircled{1}$   
 $8x + 4y - 5 = 4x + 6y - 5$   
 $4x - 2y = 0 \dots\dots\dots \textcircled{2}$   
 $12x - 2y - 8 = 0 \dots\dots \textcircled{1} \times 2$   
 $\ominus \quad 4x + 2y = 0 \dots\dots \textcircled{2}$   


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 $8x - 8 = 0$   
 $8x = 8$   
 $x = 1$   
 $6(1) - y - 4 = 0$   
 $y = 2$   
 (ii)  $|AB| = 4(1) + 2(2) + 2$   
 $|AB| = 10$   
 $\Rightarrow |DC| = 10$   
 $|BC| = 8(1) + 4(2) - 5$   
 $= 8 + 8 - 5$   
 $= 11$   
 $\Rightarrow |AD| = 11$

**Q. 5.** Proofs

**Q. 6.** (a) Students show triangles are congruent by ASA.

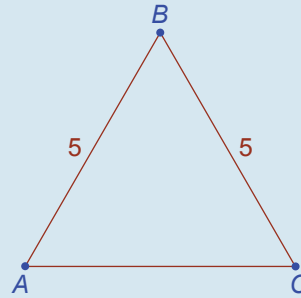
(b) Proof

**Q. 7.** (a) Proof

(b)  $|AB|^2 = 3^2 + 4^2 \quad |BC|^2 = 3^2 + 4^2$

$|AB| = \sqrt{25} \quad |BC| = \sqrt{25}$

$|AB| = 5 \quad |BC| = 5$



$\tan |\angle BCA| = \frac{5}{5} = 1$

$|\angle BCA| = \tan^{-1} 1$

$|\angle BCA| = 45^\circ$

$\triangle ABC$  is isosceles.

$\therefore |\angle BAC| = 45^\circ$

$\Rightarrow |\angle ABC| = 90^\circ$

**Q. 8.** (a)  $\frac{x+5}{x+1+x+5} = \frac{2x+2}{11x+3}$

$\frac{x+5}{2x+6} = \frac{3(2x+2)}{11x+3}$

$\frac{x+5}{2x+6} = \frac{6x+6}{11x+3}$

$(x+5)(11x+3) = (6x+6)(2x+6)$

$11x^2 + 3x + 55x + 15$

$= 12x^2 + 36x + 12x + 36$

$11x^2 + 58x + 15 = 12x^2 + 48x + 36$

$x^2 - 10x + 21 = 0$

$(x-3)(x-7) = 0$

$x = 3 \quad \text{or} \quad x = 7$

(b) Let  $|QR| = x$ .

$\frac{x}{550+x} = \frac{375}{1200}$

$1200x = 206250 + 375x$

$825x = 206250$

$x = 250 \text{ m}$

Distance between main road + town road

$= 250 \text{ m} + 550 \text{ m}$

$= 800 \text{ m or } 0.8 \text{ km}$