

Appendix 1 Online

11A

Building understanding

- 1 a 4
b 3
c i 3 ii 3 iii 3
d i 3 ii 3 iii 2
2 a 3 b 3 c 4 d 8
e The sum of degrees is twice the total number of edges.

Now you try

Example 19

- a i 5 ii 6
b i 3 ii 2 iii 3
iv 3 v 1
c 12
d i A, C, D and E ii B

Example 20

- a 3 b 4

Exercise 11A

- 1 a i 3 ii 4
b i 2 ii 3 iii 3
c 8
d i B and C ii A
2 a i 4 ii 5
b i 3 ii 1 iii 3 iv 3
c 10
d i A, B, C and D ii none
3 a i 4 ii 5
b i 2 ii 3 iii 3 iv 2
c 10
d i B and C ii A and D
4 C
5 B
6 a 2 b 3 c 3
7 C
8 a no b no c no
9 B
10 yes
11 a 8 b 16
c The sum of degrees is twice the number of edges.
12 a no b no c yes
13 a 2 b 5
14 a 6 b 4

11B

Building understanding

- 1 a Answers will vary, a rectangle of ABCD would be an example
b yes

- 2 a i 5 ii 7 iii 4
b i 9 ii 9
c They are equal.

Now you try

Example 21

no

Example 22

- a yes b no

Example 23

- a i 4 ii 6 iii 4
b $v + f = 8$ and $e + 2 = 8$

Exercise 11B

- 1 a yes b no c no
d yes e yes
2 a planar b planar c non-planar
d non-planar e planar f planar
3 a i 4 ii 6 iii 4
b $v + f = 8$ and $e + 2 = 8$
4 a i 5 ii 7 iii 4
b $v + f = 9$ and $e + 2 = 9$
5 A and C
6 A and C
7 A, B, C, D and E
8 a 12 b 6 c 4
9 a $v = 4$, $e = 6$ and $f = 4$
b $v + f = 8$ and $e + 2 = 8$
c Answers will vary.
d $v + f = 8$ and $e + 2 = 8$
10 a $v = 6$, $e = 9$ and $f = 5$
 $v + f = 11$ and $e + 2 = 11$
b $v = 8$, $e = 12$ and $f = 6$
 $v + f = 14$ and $e + 2 = 14$
11 $v = 12$, $e = 18$ and $f = 8$
 $v + f = 20$ and $e + 2 = 20$
12 a i $n = 3$, $e = 6$, $d = 3$
ii $\frac{1}{n} + \frac{1}{d} = \frac{1}{3} + \frac{1}{3} = \frac{2}{3}$
 $\frac{1}{2} + \frac{1}{e} = \frac{1}{2} + \frac{1}{6} = \frac{2}{3}$
b Answers will vary.
c $v + f = 6 + 5 = 11$ and $e + 2 = 9 + 2 = 11$. The solid is not regular so n and d cannot be determined.

11C

Building understanding

- 1 a walk b circuit
c cycle d trail
e path
2 a B and C b e.g. B-A-C-B-D-C
c Eulerian d no
e 4 f 0 or 2

Now you try

Example 24

- | | |
|---------|--------|
| a i no | ii yes |
| b i no | ii yes |
| c i yes | ii no |
| d i no | ii yes |

Example 25

Yes, Eulerian trails will be circuits.

Exercise 11C

- | | | |
|-----------------------------------|-----------------|-----|
| 1 a i yes | ii yes | |
| b i yes | ii no | |
| c i no | ii yes | |
| d i yes | ii no | |
| 2 a i yes | ii no | |
| b i yes | ii no | |
| c i no | ii yes | |
| d i yes | ii no | |
| 3 a i yes | ii no | |
| b i yes | ii no | |
| c i yes | ii no | |
| d i yes | ii no | |
| 4 a yes, yes | b yes, no | |
| c yes, no | d yes, yes | |
| e no | f no | |
| 5 a yes | b no | |
| 6 a B-A-E-D-B-C-D | b D-C-B-D-E-A-B | |
| B-A-E-D-C-B-D | D-C-B-A-E-D-B | |
| B-C-D-E-A-B-D | D-B-C-D-E-A-B | |
| B-C-D-B-A-E-D | D-B-A-E-D-C-B | |
| B-D-C-B-A-E-D | D-E-A-B-C-D-B | |
| B-D-E-A-B-C-D | D-E-A-B-D-C-B | |
| 7 a yes, 4 | b no | |
| 8 6 | | |
| 9 yes, B-C-D-E-C-G-E-F-G-B-F-A-B | | |
| 10 a graph 2 | | |
| b bridges | | |
| c 4 | | |
| d does not have an Eulerian trail | | |
| 11 a T | b T | c F |
| d F | e T | f F |
| 12 has two vertices of odd degree | | |
| 13 a i no | ii no | |
| b yes, add another DE edge | | |
| c no | | |
| d 2 | | |

11D

Building understanding

- | | | |
|-----------------|----------|-----|
| 1 a 2 | b 4 | c 3 |
| d 12 km | e 27 km | |
| 2 a i 15 km | ii 16 km | |
| b 9 km | | |
| c A, B, D and F | | |

Now you try

Example 26

- | | |
|--------|--------|
| a 13 m | b 14 m |
|--------|--------|

Example 27

- | | |
|----------|---------|
| a i 19 m | ii 15 m |
| b i 29 m | ii 25 m |

Exercise 11D

- | | | | |
|--|----------|---------|--------|
| 1 a 26 km | b 24 km | | |
| 2 a 26 m | b 39 m | | |
| 3 a 15 cm | b 19 cm | | |
| 4 a i 4 km | ii 12 km | | |
| b i 6 km | ii 5 km | | |
| 5 a 11 km | b 9 km | c 6 km | d 7 km |
| 6 8 km | | | |
| 7 a 7 cm | b 7 cm | | |
| 8 A-B-C is shorter than A-C and C-D-E is shorter than C-E. | | | |
| 9 a A-B-C-D-E-G | b \$270 | | |
| 10 a i no | ii no | iii yes | |
| b yes | | | |
| 11 a i no | ii no | iii no | iv yes |
| b 15 km | c 12 km | d no | |

Short-answer questions

- | | |
|--|-----------|
| 1 a no, BC not joined by an edge | |
| b i planar | ii planar |
| 2 a $e = 6, v = 4$ | |
| b $f = 4$ | |
| c Yes, $v + f = e + 2$ | |
| 3 a no, AC repeated | |
| b It has more than 2 odd vertices. | |
| c DF or DB or DA | |
| d Answer will vary. It will not be an Eulerian circuit as it will not have no odd vertices | |
| 4 a 15 cm | b 12 cm |

Multiple-choice questions

- | | | | |
|-----|-----|-----|-----|
| 1 C | 2 C | 3 D | 4 A |
|-----|-----|-----|-----|

Extended-response questions

- | |
|---|
| 1 a Angle in a semicircle is 90° . |
| b $\angle BCP + \angle BCA = 180^\circ$ (angles on a straight line) |
| $\therefore \angle BCP = 90^\circ$ |
| now $\angle BCP + \angle QPB = 180^\circ$ |
| and $BCQP$ is cyclic as the opposite angles are supplementary |
| c $\angle ABC = 40^\circ, \angle CBP = 140^\circ, \angle CQP = 40^\circ$ |
| d $\angle ACT = \angle ABC$ (angle between tangent and chord equals angle in alternate segment) |
| $\angle ACT = 40^\circ$ |

