Free-Response

Format: Short Answer

1. On a graph that represents six cities and the roads between them, the valence of vertex A is 4. What does this mean in real-world terms?

Format: Short Answer

2. A graph that represents six cities and the roads among them is not connected. What does this mean in real-world terms?

Format: Short Answer

3. Draw a graph representing four cities, A, B, C, and D, with a road that connects each pair of cities given:
AB, AC, BC, BD, CD

Format: Short Answer

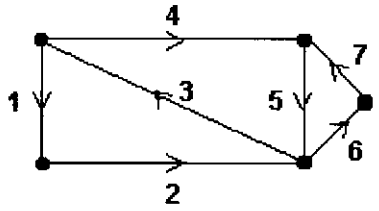
4. Draw a graph with vertices A, B, C, and D in which the valence of vertices A and D is 3 and the valence of vertices B and C is 2.

Format: Short Answer

5. Draw a graph with vertices A, B, C, and D in which the valence of each vertex is 3.

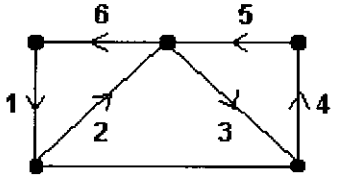
Format: Short Answer

6. Consider the path represented by the sequence of numbered edges on the graph below. Explain why the path is *not* an Euler circuit.



Format: Short Answer

7. Consider the path represented by the sequence of numbered edges on the graph below. Explain why the path is *not* an Euler circuit.

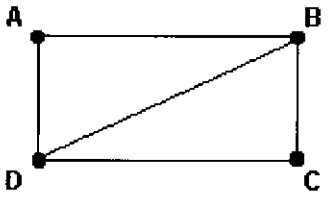


Format: Short Answer

8. Draw a graph with eight vertices, with the valence of each vertex even, that does *not* have an Euler circuit.

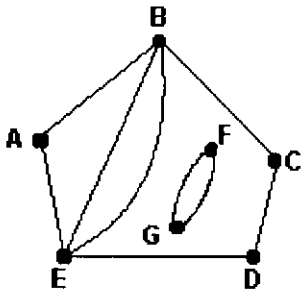
Format: Short Answer

9. Explain why the graph shown below does *not* have an Euler circuit.



Format: Short Answer

10. Explain why the graph shown below does *not* have an Euler circuit.

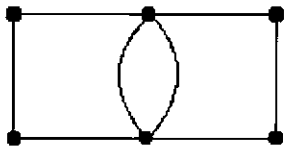


Use the following to answer questions 11-14:

Identify an Euler circuit on the following graphs by numbering the sequence of edges in the order traveled.

Reference: 1-1
Format: Short Answer

11.



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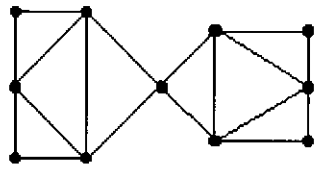
Format: Short Answer

12.



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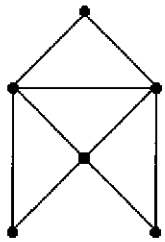
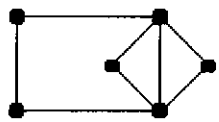
13.



Format: Short Answer

14.

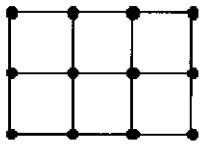


Use the following to answer questions 15-18:

Add wiggly edges to find an efficient Eulerization of the following graphs.

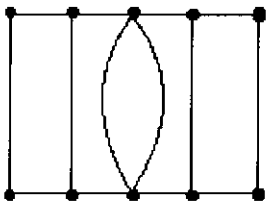
Format: Short Answer

15.



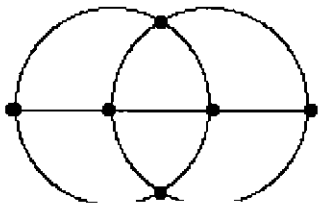
Format: Short Answer

16.



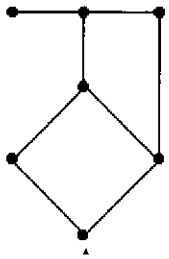
Format: Short Answer

17.



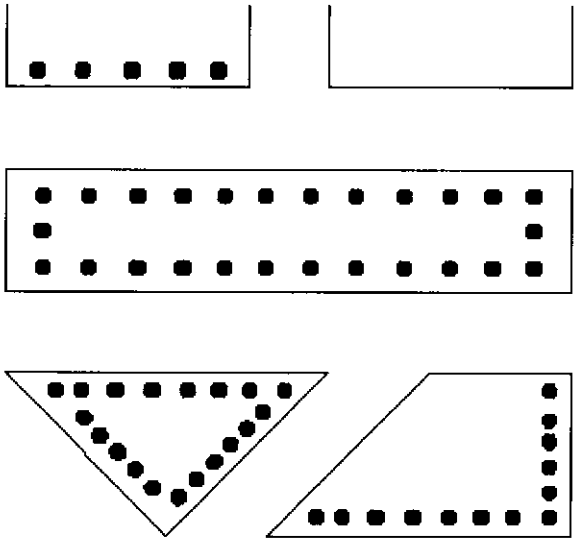
Reference: 1-2
Format: Short Answer

18.



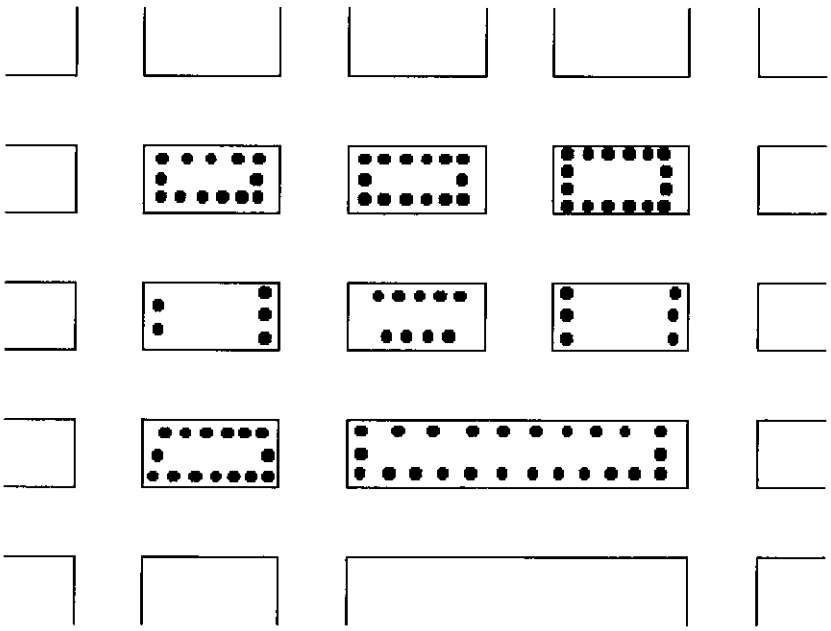
Format: Short Answer

19. The map below gives the territory of a parking control officer. The dots represent meters that must be checked. Draw the graph that would be useful for finding an efficient route.



Format: Short Answer

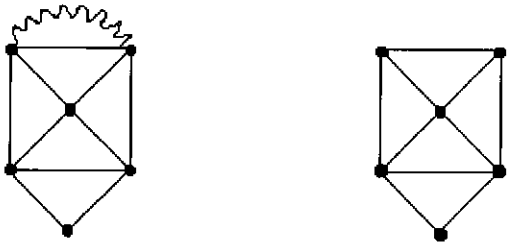
20. For the street network shown below, draw a graph that would be useful for routing a garbage truck. Assume all streets are two-way and that passing once down the street is sufficient for collecting trash from both sides.



Ans:

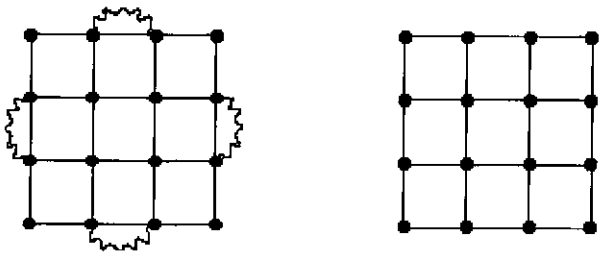
Format: Short Answer

21. Find an Euler circuit on the graph on the left and use it to find a circuit on the graph on the right that reuses one edge.



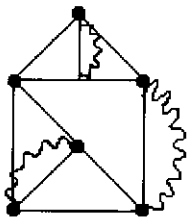
Format: Short Answer

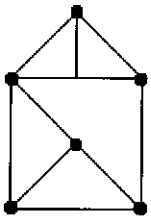
22. Find an Euler circuit on the graph on the left and use it to find a circuit on the graph on the right that reuses 4 edges.



Format: Short Answer

23. Find an Euler circuit on the graph on the left and use it to find a circuit on the graph on the right that reuses 3 edges.





Format: Short Answer

24. Why would a city street department want its snow plow operator's path to follow an Euler circuit if possible?

Format: Short Answer

25. Give three real-world applications in which a worker would want to find an Euler circuit on a street network.

Format: Short Answer

26. Draw a connected graph with 7 vertices where each vertex has valence 4.

Ans: Answers will vary. One solution is:

Format: Short Answer

27. Draw a graph with 6 vertices where the valences are 1, 2, 2, 3, 4, and 4.

Format: Short Answer

28. Find an eulerization with 9 added edges for a 3×6-block rectangular street network.

Format: Short Answer

29. Draw a graph where every vertex has a valence of at least 2, but removing a single edge disconnects the graph.

Format: Short Answer

30. Draw a graph with 5 vertices where the valence of each vertex is 4.

Ans: Answers will vary. One solution is: