



Student Name MARKING KEY

**Eastern Goldfields College
Mathematics Applications U3&4 2016**

Test 3 – Calculator Free Section

Working Time: 32 minutes

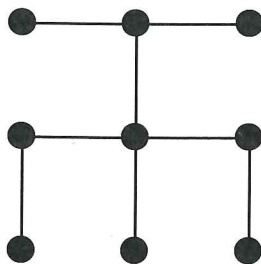
Total Marks: 29 marks

Question 1 [7 marks: 2, 1, 2, 2]

A tree graph is a planar graph with no cycles. It is an undirected graph in which any two vertices are connected by exactly one path. The following questions all refer to tree graphs.

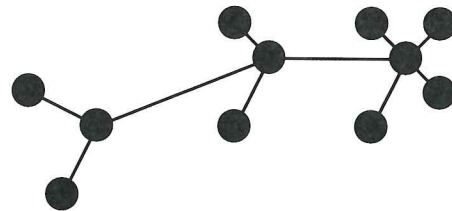
a) For the following trees state the number of vertices and the number of edges.

i)



Edges = 8
Vertices = 9 ✓ R/W

ii)



Edges = 10
Vertices = 11 ✓ R/W

b) Draw a tree with 4 vertices and 3 edges.



OR



etc

✓ R/W



c) Is it possible to draw a tree with 4 vertices and 5 edges? Explain your answer.

No ✓

Tree cannot have loops, multiple edges or cycles.

this will create at least one of these

d) Use the tree in part a) i) above and Euler's formula to explain why tree graphs are all planar.

✓ $9 + 1 - 8 = 2$
∴ planar

if edges are always 1 less than vertices ✓
and region/face is always 1
then $\sum_{f=1}^n (1 + v - e) = 2$

Question 2 [8 marks: 5, 1, 2]

a) Consider the graph on the right.

i. Which vertex is adjacent to A?

B



ii. The loop in the graph connects which vertex to itself?

D



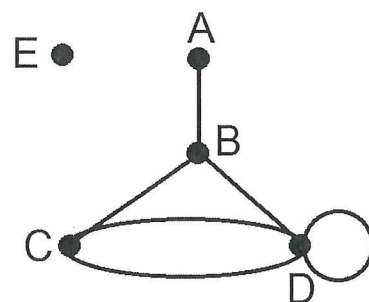
iii. Which pair of vertices is connected by multiple edges?

C and D

✓ R/W, must state both

iv. Is this a connected graph? Explain.

✓ No as vertex E is not connected by edge to any other vertex in the graph. *edge or isolated node.*



b) Draw a sub-graph of the graph on the right.

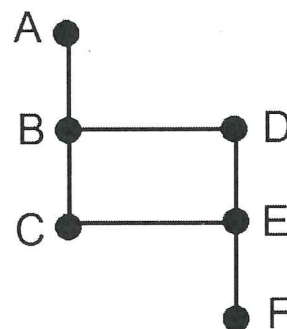


or

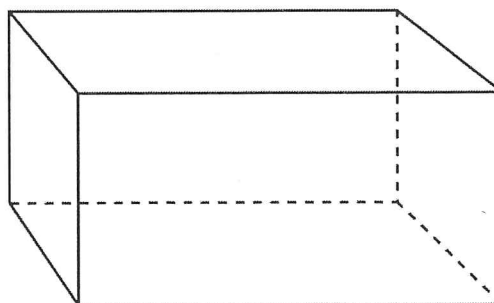
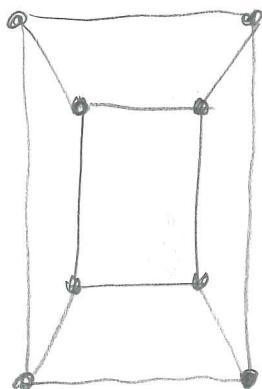


etc

✓ R/W



c) Represent the following three-dimensional prism as a planar graph.



Question 3 [6 marks: 2, 2, 2]

In a netball competition there are four teams participating.

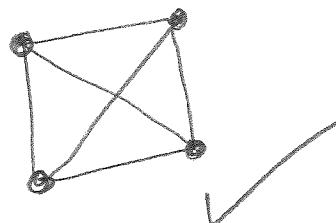
- a) If every team needs to play each other exactly once, how many games are required for the season?

6.



- b) Draw the graph showing how each team can play each other, what type of graph would this be?

complete graph ✓

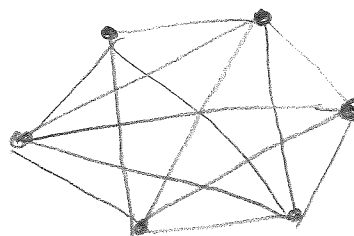


- c) If two more teams join the competition how many more games are required to be played in order for each team to still play each other exactly once?

15 games. ✓

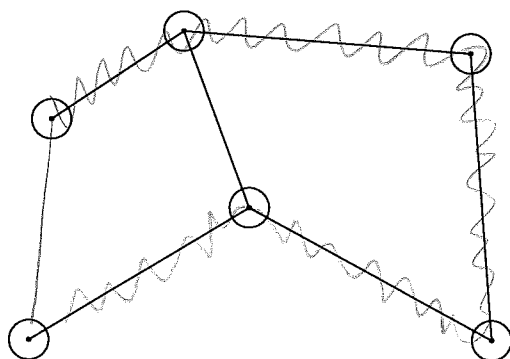
- 6

= 9 more games required ✓



Question 4 [3 marks: 1, 2]

A treasure hunt is being organised and a graph showing where prizes are hidden is shown below.



mw = semi-Hamiltonian

- a) Show a semi-Hamiltonian cycle which you could walk in order to collect all the prizes. ✓ R/W

- b) Is it possible to create a Eulerian cycle for the treasure hunt by adding exactly one path? If so, show the path on the graph above.

No ✓

any edge that connects any 2 odd nodes together will still leave 2 odd nodes. This is semi-Eulerian. ✓

Question 5 [8 marks: 2, 2, 2, 1, 1]

A tabloid magazine is comparing the amount of time some famous mothers spend on washing, cleaning and shopping per week.

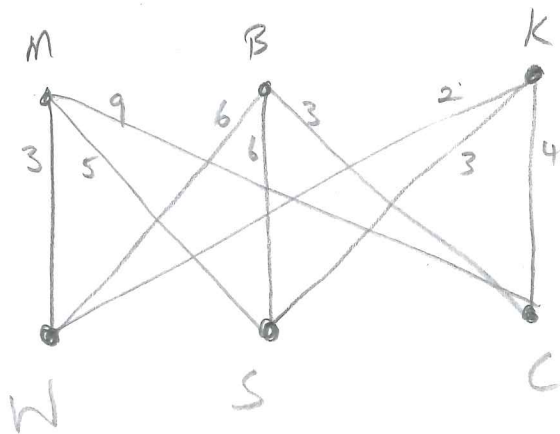
Marg spends 3 hours on washing, 5 hours shopping and 9 hours cleaning each week. Bec spends, 6 hours on washing, 6 hours shopping and 3 hours cleaning each week and Kate spends 2 hours washing, 3 hours shopping and 4 hours cleaning each week.

- a) Complete the following matrix showing the time (in hours) spent by each of the three mothers on these tasks each week. The rows in order represent the three mothers, Marg, Bec and Kate. The columns in order represent the tasks, washing, shopping and cleaning.

	w	s	c
m	3	5	9
B	6	6	3
K	2	3	4

✓✓ r/w

- b) Present the matrix from part a) as a labeled and weighted bipartite graph.



✓ labels, weights.

✓ bipartite

- c) Is this bipartite graph complete or incomplete? Explain.

complete
✓

all vertices in one set (mothers) connect to all vertices in the other set (time) exactly 1 edge.

- d) Who spends the most time cleaning?

Marg ✓

- e) What is the total amount of time Bec spends on all these tasks?

$$6 + 6 + 3 = 15 \text{ hours}$$

✓