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46.



# Eastern Goldfields College Mathematics Applications 2017

## Test 3 – Calculator Free

Eastern Goldfields College

Time allowed: 36 minutes

Total Marks: 29 marks

No calculator or notes permitted for this section.

Answer all of the following questions. Show all working to obtain full marks.

### Question 1 (4 marks: 1, 1, 2, 1)

$$A = \begin{bmatrix} 2 & 3 \\ 5 & 7 \\ -1 & 8 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 2 & 8 \\ 7 & 0 & 11 \end{bmatrix} \quad C = \begin{bmatrix} -4 \\ -1 \\ 3 \end{bmatrix} \quad D = \begin{bmatrix} 2 & 5 & 10 \end{bmatrix} \quad E = \begin{bmatrix} 7 & 9 \\ 11 & 3 \\ 10 & 5 \end{bmatrix} \quad F = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

Using the matrices given above, calculate the following. Where the operation is not possible, provide an explanation.

|  |   |
|--|---|
| a) $E + A$<br>$3 \times 2 + 3 \times 2$  | b) $DC$<br>$1 \times 2 \times 2 \times 1$   |
| $\begin{bmatrix} 7 & 9 \\ 11 & 3 \\ 10 & 5 \end{bmatrix} + \begin{bmatrix} 2 & 3 \\ 5 & 7 \\ -1 & 8 \end{bmatrix} = \begin{bmatrix} 9 & 12 \\ 16 & 10 \\ 9 & 13 \end{bmatrix}$ | $\begin{bmatrix} 2 & 5 & 10 \\ -8 & -5 & 10 \end{bmatrix} \begin{bmatrix} -4 \\ -1 \\ 3 \end{bmatrix} = \begin{bmatrix} 17 \end{bmatrix}$ |
| c) $A^2$<br>$3 \times 2 \times 3 \times 2$   | d) $3B$   |
| Cannot be determined<br>$\because A_{col} \neq A_{rows}$   | $\begin{bmatrix} 3 & 6 & 24 \\ 21 & 0 & 33 \end{bmatrix}$   |

### Question 2 (1 mark)

Determine the price to earnings ratio for a share with a price of \$6.00 and dividends in the last twelve months totalling 75 cents per share.

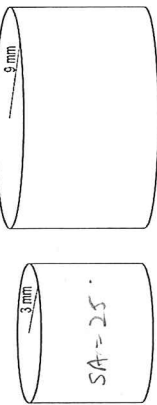
$$\frac{6.00}{75} = 8$$

### Question 3 (4 marks: 2, 2)

The figures below are similar.

- a) The surface area of the smaller cylinder is  $25 \text{ mm}^2$ . What is the surface area of the larger cylinder?

$$3:9$$



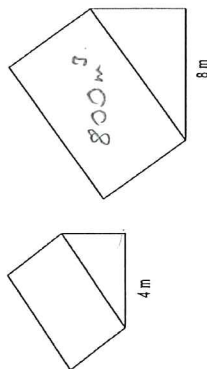
$$2:1:1:3$$

$$A: 1:9$$

$$25 \times 25 = 225 \text{ mm}^2$$

- b) The prisms below are similar. The volume of the larger prism is  $800 \text{ m}^3$ . What is the volume of the smaller prism?

$$4:8$$



$$2:1:2$$

$$V: 1:8$$

$$800$$

$$800 \div 8 = 100 \text{ m}^3$$

### Question 4 [4 marks: 2, 2]

Charlene was calculating with matrices. She got the following answers incorrect. Explain what she did wrong and write the correct solution.

a)  $\begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}^2 = \begin{bmatrix} 4 & 9 \\ 16 & 25 \end{bmatrix}$  X X squared each element ✓

$$\begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix} \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix} = \begin{bmatrix} 4+12 & 6+15 \\ 8+20 & 12+25 \end{bmatrix} = \begin{bmatrix} 16 & 21 \\ 28 & 37 \end{bmatrix}$$

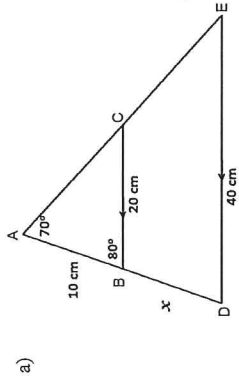
b)  $A \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix} \times \begin{bmatrix} 3 & 4 \\ 12 & 10 \end{bmatrix} = \begin{bmatrix} 10 & 12 \\ 12 & 10 \end{bmatrix}$  X  $a_{11} \times b_{11} = c_{11}$  X  
element  $\times$  element ✓

$$\begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix} \begin{bmatrix} 5 & 4 \\ 3 & 2 \end{bmatrix} = \begin{bmatrix} 10+9 & 8+6 \\ 20+15 & 16+10 \end{bmatrix} = \begin{bmatrix} 19 & 14 \\ 35 & 26 \end{bmatrix}$$

### Question 5 (8 marks: 4, 4)

For each of the following similar triangles:

- Justify why they are similar
- Solve for  $x$



$$\frac{BC}{DE} = \frac{AB}{AD}$$

$$\frac{20}{10} = \frac{40}{x}$$

$$1 : 2$$

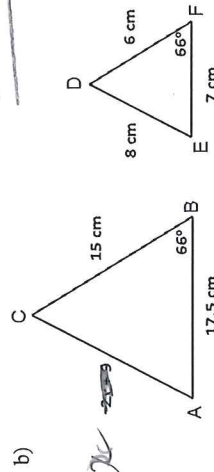
corresponding angles are equal.

$$\therefore \triangle ABC \sim \triangle ADE \therefore AAA$$

$$\angle DAE = \angle BAC = 70^\circ$$

$$\angle ABC = \angle ADE = 80^\circ \rightarrow$$

$$\angle ACB = \angle AED = 180 - 80 - 70 = 30^\circ$$



$$\angle ABC = \angle FED = 66^\circ$$

$$\frac{AB}{FE} = \frac{BC}{FD}$$

$$\frac{17.5}{8} = \frac{15}{7}$$

$$35 : 14$$

$$2\frac{1}{2} : 1$$

$$\triangle ABC \sim \triangle FED \therefore SAS$$

$$\frac{AC}{ED} = \frac{BC}{FD}$$

$$\frac{15}{8} = \frac{17.5}{7}$$

$$15 : 10$$

$$3 : 2$$

$$2\frac{1}{2} \times 8 = 20$$

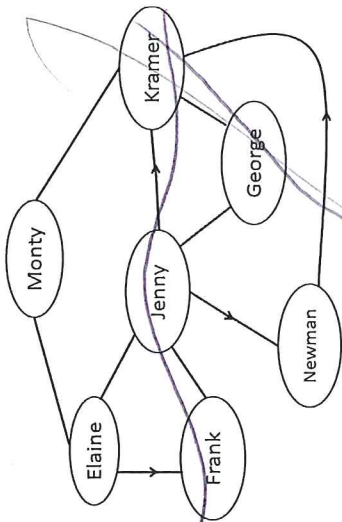
$$17 = 20$$

$$8 = 20$$

$$x = 4 \text{ cm}$$

### Question 6 (6 marks: 3, 1, 2)

The network (right) shows who has who's mobile numbers in their contacts on their mobile phone.



- Complete the matrix,  $M$ , below to represent the route matrix for the mobile number network above.

$$M =$$

|        | Monty | Elaine | Jenny | Kramer | Frank | Newman | George |
|--------|-------|--------|-------|--------|-------|--------|--------|
| Monty  | 0     | 1      | 0     | 1      | 0     | 0      | 0      |
| Elaine | 1     | 0      | 1     | 0      | 1     | 0      | 0      |
| Jenny  | 0     | 1      | 0     | 1      | 1     | 1      | 1      |
| Kramer | 1     | 0      | 0     | 0      | 0     | 0      | 1      |
| Frank  | 0     | 1      | 1     | 0      | 0     | 0      | 0      |
| Newman | 0     | 0      | 1     | 0      | 0     | 0      | 0      |
| George | 0     | 0      | 1     | 1      | 0     | 0      | 1      |

- In matrix  $M$  above, what do the numbers on the leading diagonal represent?

- The square of matrix  $M$  is listed below. What does the zero in element 4, 5 of matrix  $M^2$  represent?

$$M^2 =$$

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 2 | 0 | 1 | 0 | 1 | 0 | 1 | 1 |
| 0 | 2 | 1 | 2 | 1 | 1 | 1 | 1 |
| 2 | 0 | 3 | 2 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 1 | 1 | 1 | 1 | 2 |



Eastern Goldfields College

Student Name \_\_\_\_\_

## Eastern Goldfields College Mathematics Applications 2017

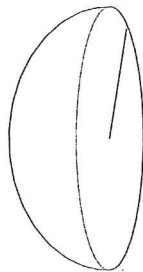
### Test 3 – Calculator Assumed

Total Marks: 24 marks

Time allowed: 25 minutes

#### Question 7 (2 marks)

The following hemisphere has a volume of  $150 \text{ cm}^3$ .  
Reduce the size of the hemisphere by a scale factor of 3 and  
calculate the volume of the smaller hemisphere.



$$\frac{150}{27} = 5.5 \text{ cm}^3$$

$$1:3 \\ 1:27$$

#### Question 8 (6 marks: 2, 2, 2)

John wants to see which of the two banks in his portfolio of shares the better performer is, and he decides to use the P/E ratio to compare the two banks.

$$P/E \text{ ratio} = \frac{\text{Market price per share}}{\text{Annual earnings per share}}$$

AAA Bank's shares are currently \$33.65 while ZZZ Bank's shares are currently \$32.055.

AAA Bank has annual earnings of 207.5 cents per share.

ZZZ Bank has annual earnings of 223.1 cents per share.

a) Calculate the P/E ratio for each bank

$$AAA = \frac{33.65}{207.5}$$

$$222 = \frac{32.055}{2.231}$$

$$= 16.21687$$

b) Make a recommendation as to which bank John should buy more of, if the P/E ratio was the only indicator to be used. Justify your recommendation.

ZZZ is lowest

for every \$14.37 he spends he receives \$1

c) Dividends from both banks are paid twice a year and in the last year AAA Bank gave dividends at 82c and 84c per share. What percentage of its annual earnings does AAA Bank distribute to shareholders?

$$\frac{82+84}{207.5}$$

$$82\%$$

#### Question 9 (6 marks: 3, 3)

Youth Allowance gives financial aid to people aged 16 to 24 studying full time, training, looking for work or sick. Payment rates are:

| Status  | Fortnightly Payment |
|---|---------------------|
| Single less than 18 years living at home      | \$226.80            |
| Single less than 18 years not living at home  | \$414.40            |
| Single older than 18 years living at home     | \$272.80            |
| Single older than 18 years not living at home | \$414.40            |
| Single with children                          | \$542.90            |

Youth Allowance students can earn an income but this reduces the fortnightly payment according to the following table:

| Income / fortnight | Reduction in fortnightly payments          |
|--------------------|--|
| \$414 and below    | Nil  |
| \$415 - \$498      | 50 c for every dollar over \$414           |
| \$499 and over     | \$42 plus 60 c for every dollar over \$498 |

Gerry is single, 17 years old and lives at home. He earns \$10,000 p.a. on part-time jobs and is studying full time. Richard is 21 years old and does not live at home. He studies full-time and works part-time. His yearly income is \$13,520.

Gerry and Richard receive \$226.80 and \$359.20 per fortnight respectively in youth allowance. Using the tables above, justify Gerry's and Richard's youth allowance payments.

Gerry

$$\frac{10000}{26} = 384.61538$$

$$\$384.62 < \$414$$

∴ Nil reduction

∴ receives full allowance of

$$\$226.80$$

Richard

$$\frac{13520}{26} = 520$$

\$20 > 499 ∴ reduction of:

$$\$42 + 0.6(520 - 498)$$

$$= 42 + 13.2$$

$$= 55.20$$

$$414.40 - 55.20$$

$$= \$359.20$$

$$= \$359.20$$



### Question 10 (5 marks: 1, 1, 3)

Two friends went on a trip overseas and brought back some unspent foreign currency which they need to exchange back to Australian dollars (AUD).

They have made a table showing the amounts of each currency they each have.

|      | Bali (Indonesia) | Singapore |
|------|------------------|-----------|
| Kate | 190 000 IDR      | 200 SGD   |
| Guy  | 175 000 IDR      | 350 SGD   |

The exchange rates when they convert their money are as follows:

$$10\,000 \text{ IDR (Indonesian rupiah)} = 0.9700 \text{ AUD}$$

$$1 \text{ SGD (Singapore dollars)} = 0.8666 \text{ AUD}$$

- a) How much in Australian dollars (to the nearest ten cents) will Kate get for her Indonesian rupiah (assuming she pays no commission fees)?

$$190\,000 \div 10\,000 \times 0.97 = \$18.43 \text{ Au.} \quad \$18.40$$

- b) Justify why one Australian dollar is approximately 10 309 Indonesian Rupiah.

$$\frac{1}{0.97} = 1.0309 \quad 10000 \div 0.97 = 10309.278 \approx 10309 \text{ IDR}$$

- c) Who is left with the most money when they return to Australia? Justify your answer.

KATE

$$200 \text{ SGD} \times 0.8666 = 173.32$$

$$+ 18.43 = \$191.75$$

GUY

$$350 \times 0.8666 = \$303.31 \text{ Au.}$$

$$175\,000 \div 10000 \times 0.97 = \$16.975$$

$$= \$320.285$$

$$\text{GUY by } 320.285 - 191.75 = \$128.535$$

### Question 11 (5 marks: 1, 2, 2)

Swimming's Cool is a company which produces swimming pools. They have three different models of pool which they sell and each one requires a different amount of each of the following materials as shown in matrix **A** below.

|         | Fiberglass (Sheets) | Concrete (kg) | Tiles (number) | Gravel (bags) |
|---------|---------------------|---------------|----------------|---------------|
| Model A | 1                   | 100           | 30             | 20            |
| Model B | 3                   | 120           | 90             | 90            |
| Model C | 2                   | 150           | 50             | 70            |

$$A = \begin{bmatrix} 1 & 100 & 30 & 20 \\ 3 & 120 & 90 & 90 \\ 2 & 150 & 50 & 70 \end{bmatrix}$$

- a) Swimming's Cool receives the following orders: 4 of Model A, 2 of Model B and 1 of Model C. Create matrix **B** to represent this information.

$$B = \begin{bmatrix} 4 & 2 & 1 \end{bmatrix} \quad \text{accept } \begin{bmatrix} 4 \\ 2 \\ 1 \end{bmatrix}$$

- b) Use matrix methods to calculate the total amount of each material needed to fill the order.

$$1 \times 3 \quad 3 \times 4 = 1 \times 4$$

$$\begin{bmatrix} 4 & 2 & 1 \end{bmatrix} \begin{bmatrix} 100 & 30 & 20 \\ 120 & 90 & 90 \\ 150 & 50 & 70 \end{bmatrix} = \begin{bmatrix} 790 & 330 & 330 \end{bmatrix}$$

- c) The costs for each of the materials are as follows:

| Fiberglass (\$300/Sheet) | Concrete (\$50/kg) | Tiles (\$5 each) | Gravel (\$70/bag) |
|--------------------------|--------------------|------------------|-------------------|
|--------------------------|--------------------|------------------|-------------------|

Calculate, using matrix methods and showing full working, the total cost of the order.

$$\begin{bmatrix} 790 & 330 & 330 \end{bmatrix} \times \begin{bmatrix} 300 \\ 50 \\ 5 \\ 70 \end{bmatrix} = \begin{bmatrix} 237000 \\ 39500 \\ 1750 \\ 23100 \end{bmatrix}$$

$$\text{Total Cost} = \$69950$$

End of Test