+ MARKS ALLOCATION.

Student Name SOLUTIONS

Eastern Goldfields College
Mathematics Applications 2018

Test 3 – Calculator Free

Time allowed: 22 minutes **Total Marks: 22 marks**

No calculator or notes permitted for this section.

Show all working where appropriate to obtain full marks.

Question 1 (5 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

$$\begin{bmatrix}7 & 9\\ 11 & 3\\ 10 & 3\end{bmatrix}+\begin{bmatrix}2 & 3\\ 5 & 7\\ -1 & 8\end{bmatrix}=\begin{bmatrix}9 & 12\\ 16 & 10\\ 9 & 13\end{bmatrix}$$ ✓

b) DC

$$\begin{bmatrix}2 & 5 & 10\end{bmatrix}\begin{bmatrix}-4\\ -1\\ 3\end{bmatrix}=\begin{bmatrix}17\end{bmatrix}$$ ✓

c) A^2

3×2 3×2

≠ ✓

Cannot be determined

A col ≠ A rows ✓ must be clear

d) 3B

$$\begin{bmatrix}3 & 6 & 24\\ 21 & 0 & 33\end{bmatrix}$$ ✓

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.

$\frac{6}{0.75} = 8$ ✓ no marks for just this

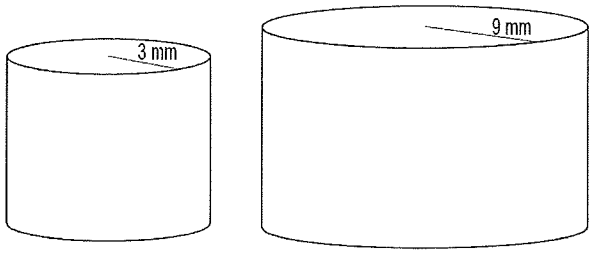
must have answer right/wrong

$\frac{600}{75} = 8$ If $8 accept.

Question 3 (4 marks: 2, 2)

The figures below are similar.

a) The surface area of the smaller cylinder is 25 mm^2. What is the surface area of the larger cylinder?



$K=3$

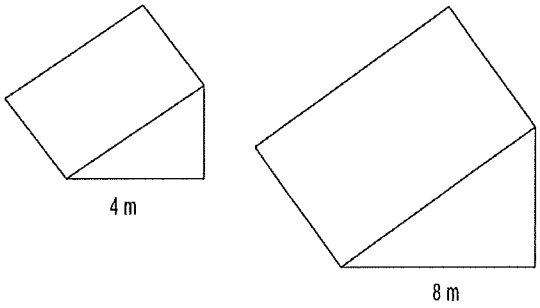
$K^2=9$ ✓

$25 \times 9 = 225 \text{ mm}^2$

✓

* no marks for $25 \times 3 = 75$

b) The prisms below are similar. The volume of the larger prism is 800 m^3. What is the volume of the smaller prism?



$K=\frac{1}{2}$

$800 \times \left(\frac{1}{2}\right)^3 = 100 \text{ m}^3$ ✓

* no marks for $800 \div 2$

or $K=8$

$800 \div 8 = 100$

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) $\begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}^2 = \begin{bmatrix} 4 & 9 \\ 16 & 25 \end{bmatrix}$ ✗

she has squared the elements of the matrix when she should have multiplied the whole matrix by itself.

$\begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix} \times \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix} = \begin{bmatrix} 16 & 21 \\ 28 & 37 \end{bmatrix}$ ✓ right/wrong

* must state what she did wrong NOT what she was supposed to do

b) $\begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix} \times \begin{bmatrix} 5 & 4 \\ 3 & 2 \end{bmatrix} = \begin{bmatrix} 10 & 12 \\ 12 & 10 \end{bmatrix}$ ✗

She has multiplied corresponding elements ✓ ie $2 \times 5 = 10$ ✗

$\begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix} \times \begin{bmatrix} 5 & 4 \\ 3 & 2 \end{bmatrix} = \begin{bmatrix} 19 & 14 \\ 35 & 26 \end{bmatrix}$ ✓ right/wrong

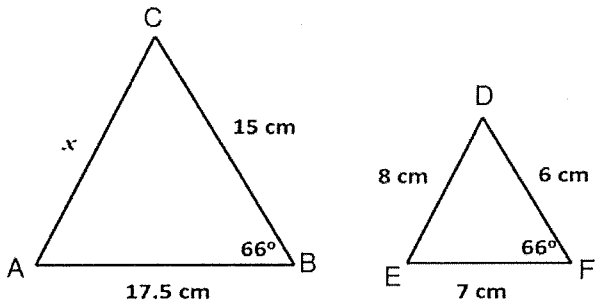
accept 'multiplied individual numbers'

Question 5 (8 marks: 4, 4)

For each of the following similar triangles:

i) Name the similar triangles
ii) Explain why they are similar
iii) Determine the value of x

a)



or $15 \div 6 = 2.5$
$17.5 \div 7 = 2.5$ ✓ evidence

$15 : 6 = 17.5 : 7$

$30 : 12$ $35 : 14$

$2.5 : 1$ $2.5 : 1$

5:2 5:2

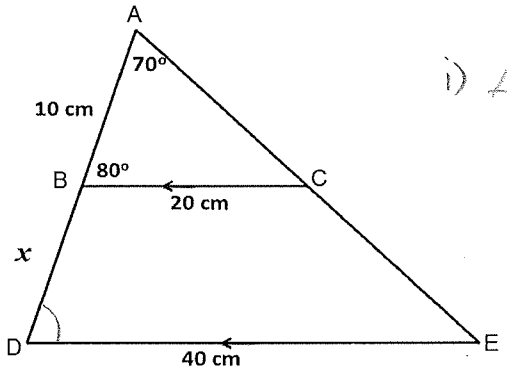
or $k = 2.5$ ✓

i) $\triangle ABC \sim \triangle EFD$ ✓ or others

ii) Corresponding sides in same ratio & included angles are equal. ✓

iii) $8 \times 2.5 = 20\text{cm}$ ✓

b)



i) $\triangle ABC \sim \triangle ADE$ ✓ or others

ii) Corresponding angles are equal. ✓

iii) $k = 2$

$10 : 20$ or $1 : 2$ ✓ evidence

$\angle B = \angle D$
$\angle C = \angle E$

$\therefore 10 + x = 20$

$x = 10\text{cm}$ ✓

Student Name _____

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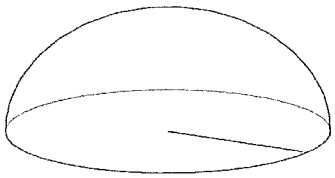
Test 3 – Calculator Assumed

Time allowed: 25 minutes **Calculator and Notes permitted** **Total Marks: 24**

Question 7 **(2 marks)**

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



$\frac{150}{27}$ ✓ $= 5.\dot{5}\ cm^3$ ✓

$k = \frac{1}{3}$

$k^3 = \frac{1}{27}$

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.

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

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 $= \frac{33.65}{2.075}$

$= 16.21687$ ✓

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

$= 14.367996$ ✓

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 ✓ as lowest (spends less to get a \$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?

$82 + 84 = 166$ ✓

$\frac{166}{207.5} \times 100 = 80\%$ ✓

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 mathematically Gerry's and Richard's youth allowance payments.

Gerry $\frac{10000}{26} = 384.62$/ft ✓

$384.62 < 414$

∴ Nil reduction ✓

∴ receives full allowance of $226.80 ✓

Richard $\frac{13520}{26} = \$520$/ft ✓

$520 > 499$ ∴ reduction

$42 + 0.6(520 - 498)$

$= 42 + 13.2$

$= 55.20$ ✓

Receives $= 414.40 - 55.20$

$= \$359.20$ ✓

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 IDR (Indonesian rupiah) = 0.9700 AUD

1 SGD (Singapore dollars) = 0.8666 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)?

$190\,000 \div 10000 \times 0.97$

$= \$18.43$ $\therefore \$18.40$ ✓

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

$10000 \div 0.97$ ✓

~ 10309 IDR

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

KATE

$200 \text{ SGD} \times 0.8666$

$= 173.32$

$173.32 + 18.43$

$= \$191.75$

GUY

350×0.8666

$= \$303.31$

$175000 \div 10000 \times 0.97$

$= 16.975$

$303.31 + 16.975$

$= \$320.29$

GUY by $\$128.54$

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.

$$\mathbf{A} = \begin{array}{c} \\ \text{Model A} \\ \text{Model B} \\ \text{Model C} \end{array} \begin{array}{c} \begin{array}{cccc} \text{Fiberglass} & \text{Concrete} & \text{Tiles} & \text{Gravel} \\ \text{(Sheets)} & \text{(kg)} & \text{(number)} & \text{(bags)} \end{array} \\ \begin{bmatrix} 1 & 100 & 30 & 20 \\ 3 & 120 & 90 & 90 \\ 2 & 150 & 50 & 70 \end{bmatrix} \end{array}$$

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.

$B = [4 \ 2 \ 1]$ ✓ 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.

$$[4 \ 2 \ 1] \begin{bmatrix} 1 & 100 & 30 & 20 \\ 3 & 120 & 90 & 90 \\ 2 & 150 & 50 & 70 \end{bmatrix} = [12 \ 790 \ 350 \ 330]$$

✓ ✓

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.

$$[12 \ 790 \ 350 \ 330] \times \begin{bmatrix} 300 \\ 50 \\ 5 \\ 70 \end{bmatrix} = [67950]$$

✓

Total Cost $67950 ✓

End of Test