Eastern Goldfields College
Mathematics Applications U1 2019
Assignment – Calculator Free

Time allowed: 17 minutes   Total Marks: 17 marks

Show all working where appropriate to maximise your marks.

Question 1   (2 marks – 1,1)

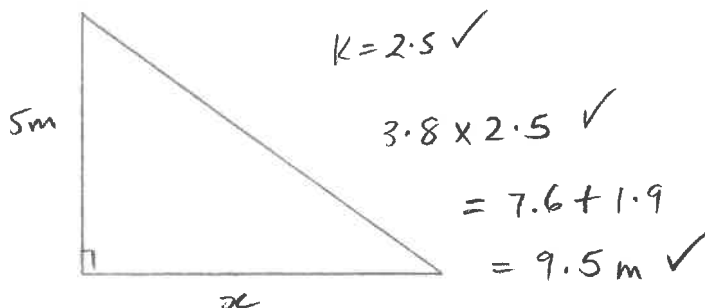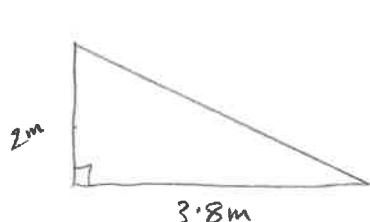(a)   If $y = x^2 - 2x + 4$ determine y when x = - 5
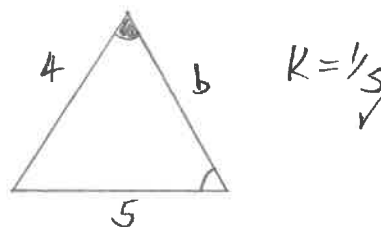
$y = (-5)^2 - 2(-5) + 4$
$\quad = 25 + 10 + 4 \quad = 39$ ✓

(b)   Evaluate 18 ÷ 3 x 2 - 7   = 5 ✓
         6   x2-7
         12-7

Question 2   (9 marks – 3, 3, 3)

(a)   At a certain time of day, the shadow of a 2 m tall post is 3.8 m long. Determine, at the same time of day, the length of the shadow of a tree that is 5 m tall.

$k = 2.5$ ✓

3.8×2.5 ✓

$= 7.6 + 1.9$

$= 9.5 \text{ m}$ ✓

(b)   The two triangles shown below are similar. Determine the lengths a and b.

$k = \frac{1}{5}$ ✓
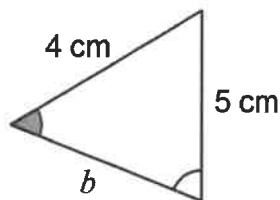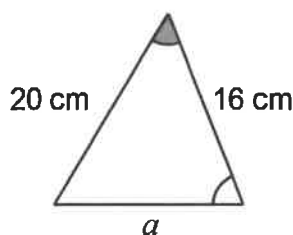
$a = 25$ ✓ $b = \frac{16}{5} = 3.2 \text{ cm}$ ✓

(c)   An image, with one side that is 17 cm long, is enlarged so that the same side now measures 51 cm. If the original area of the image was 250 cm², determine the area of the enlargement.

$k = 3$ ✓   so $250 \times 3^2 = 2250 \text{ cm}^2$ ✓ ✓

Question 3   (6 marks – 1, 2, 3)

A system of one-way and two-way paths connects three locations A, B and C. There may be more than one path between any two locations. The table below shows the number of ways to travel between these locations using a single path.

		To		
		A	B	C
	A	0	1	1
From	B	0	0	2
	C	2	2	0

(a)   Is the path between A and B one-way or two-way? Justify your answer.

one-way   *B—A '0' ways, but A–B '1' way*

✓ *one-way & reason.*

(b)   Complete the network diagram below to show the information in the table.

✓✓
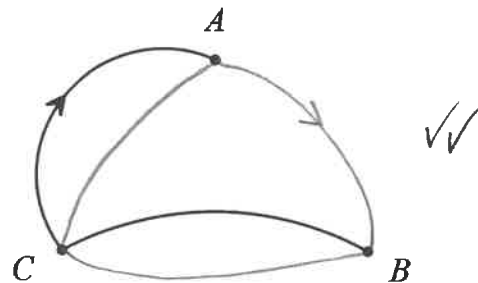
(c)   Arrange the information from the table in a matrix M and determine the matrix M^2.

$$M = \begin{bmatrix} 0 & 1 & 1 \\ 0 & 0 & 2 \\ 2 & 2 & 0 \end{bmatrix}$$ ✓

$$M^2 = \begin{bmatrix} 0 & 1 & 1 \\ 0 & 0 & 2 \\ 2 & 2 & 0 \end{bmatrix} \times \begin{bmatrix} 0 & 1 & 1 \\ 0 & 0 & 2 \\ 2 & 2 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 2 & 2 & 2 \\ 4 & 4 & 0 \\ 0 & 2 & 6 \end{bmatrix}$$

✓ *2 rows correct*
✓ *all correct.*

Student Name *SOLUTIONS*

Eastern Goldfields College
Mathematics Applications U1 2019

Assignment – Calculator Assumed

Time allowed: 20 minutes   Total Marks: 18 marks

Calculator only permitted for this section, no notes.

Show all working where appropriate to maximise your marks.
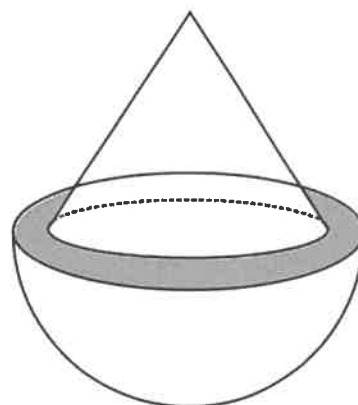
Upward & Onward

Question 1   (9 marks – 1, 2, 3, 3)

A solid cone of radius 12 cm and height 16 cm is placed symmetrically atop a solid hemisphere of radius 14 cm to form the composite solid shown right.

(a)   Use Pythagoras' Theorem to calculate the slant height of the cone.

$$h^2 = 12^2 + 16^2$$
$$h = 20 \text{ cm} \checkmark$$

(b)   Determine the area of the grey shaded ring, between the cone and the hemisphere, as shown in the diagram above.

$$A_1 = \pi \times 14^2 = 615.75 \checkmark \qquad A_1 - A_2 = 163.4 \text{ cm}^2 \checkmark \quad \sim 163 \text{cm}^2$$
$$A_2 = \pi \times 12^2 = 452.39 \qquad\qquad\qquad (.36)$$

(c)   Determine the surface area of the composite solid.

$$A = \pi \times 12 \times 20 + 163.4 + 2\pi \times 14^2$$
$$\qquad\quad (753.98) \checkmark \qquad\qquad\qquad (1231.504)$$
$$= 2148.9 \text{ cm}^2 \checkmark$$
$$\quad (.886557)$$

(d)   Calculate the volume of the composite solid.

$$V = \pi \times 12^2 \times 16 \div 3 + \tfrac{2}{3}\pi \times 14^3$$
$$\qquad (2412.74) \checkmark \qquad\qquad\qquad \checkmark$$
$$= 8159.76 \text{ cm}^3 \qquad (5747.02)$$
$$\checkmark$$

Question 2 (9 marks – 1, 1, 2, 2, 3)

The number of hours of labour required by each of workers A, B and C during the manufacture of three products P, Q and R is shown in the matrix M below.

$$
\begin{array}{c} \\ A \\ B \\ C \end{array}
\begin{array}{c} P \quad Q \quad R \\ \begin{bmatrix} 3 & 2 & 2 \\ 0 & 4 & 3 \\ 4 & 1 & 2 \end{bmatrix} \end{array} \quad 3 \times 3
$$

(a) Explain the significance of the number in the second row and first column.

No labour hours needed for Worker B for product P. ✓

(b) Due to differing experience, workers A, B and C are paid \$16, \$20 and \$22 per hour respectively. Express this information in the row matrix N that is consistent with the information in matrix M.

$$N = \begin{bmatrix} 16 & 20 & 22 \end{bmatrix} \checkmark$$
$$1 \times 3$$

(c) Determine the product of matrices M and N, in whatever order is possible, and explain what the resulting matrix S shows.

$$
\begin{bmatrix} 16 & 20 & 22 \end{bmatrix} \times \begin{bmatrix} 3 & 2 & 2 \\ 0 & 4 & 3 \\ 4 & 1 & 2 \end{bmatrix}
$$

$$
= \begin{bmatrix} 136 & 134 & 136 \end{bmatrix} \checkmark \quad \text{Labour costs for manufacturing} \checkmark
$$
$$1 \times 3 \qquad\qquad\qquad \text{products } P, Q \text{ \& } R.$$

A standard production run consists of the manufacture of 3, 1 and 2 of products P, Q and R respectively.

(d) Write down a suitable matrix T so that the product ST will show the total labour cost for a standard production run and determine this total labour cost.

$$
\begin{bmatrix} 136 & 134 & 136 \end{bmatrix} \times \begin{bmatrix} 3 \\ 1 \\ 2 \end{bmatrix} \checkmark = \begin{bmatrix} 814 \end{bmatrix} \checkmark
$$
$$1 \times 1$$

(e) During a standard production run, worker B is not available.

To maintain production, worker A takes on an extra four hours for product Q and worker C takes on an extra three hours for product R.

Determine, with justification, the effect this has on the total labour cost for a standard production run.

$$
\begin{bmatrix} 16 & 20 & 22 \end{bmatrix} \times \begin{bmatrix} 3 & 6 & 2 \\ 0 & 0 & 0 \\ 4 & 1 & 5 \end{bmatrix} \qquad \begin{bmatrix} 136 & 118 & 142 \end{bmatrix} \times \begin{bmatrix} 3 \\ 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 810 \end{bmatrix} \checkmark
$$

$$
= \begin{bmatrix} 136 & 118 & 142 \end{bmatrix} \checkmark \qquad\qquad \text{\$4 decrease.} \checkmark
$$

End of Validation