Year 11 Mathematics Applications (AEMAA)
Test 3   Semester 2 2021

SHENTON COLLEGE

Name: __Solutions__

Teacher: Day   Friday   Hill   Kelly   Loh   Staffe

CALCULATOR FREE

Materials allowed: Formula sheet
Show full working to obtain full marks for each of the questions in this section.

Time: 15 minutes

CF	/24
CA	/40
Units Deduction	
Total	/64

Question 1 [5 marks: 2,3]
Solve the following equations for the unknown variable.

a) $2x - 12 = 3$

✓ rearrange
$$2x = 15$$
$$x = 7.5 \text{ or } \frac{15}{2}$$
✓ solve

b) $-3(x - 2) - 5 = 10$

✓ expand
$$-3x + 6 - 5 = 10$$
$$-3x + 1 = 10$$ ✓ rearrange
$$-3x = 9$$
$$x = -3$$ ✓ solve
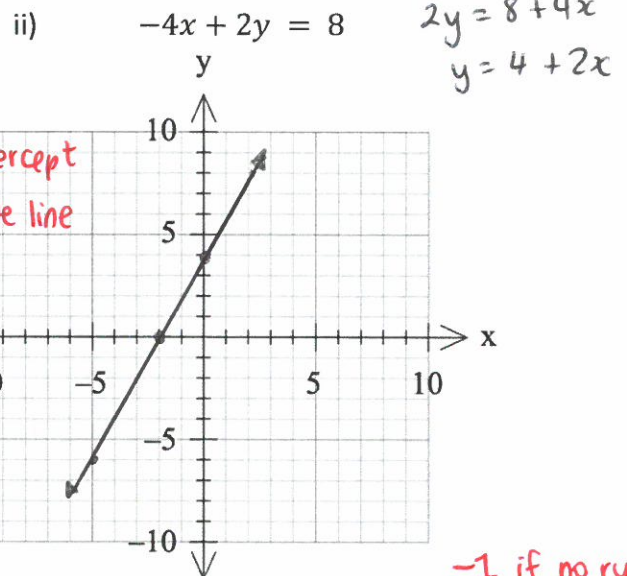
OR
$$-3(x-2) = 15$$
$$x - 2 = -5$$
$$x = -3$$

Question 2 [8 marks: 4, 4]
a) Draw the following straight lines on the axes below.

i) $y = -x + 2$
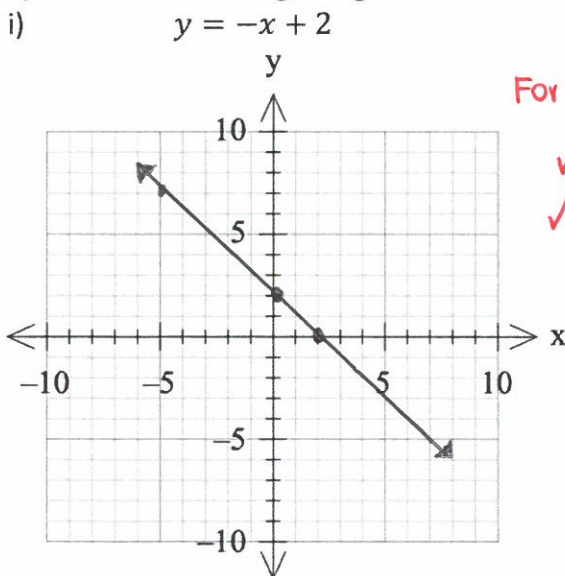
ii) $-4x + 2y = 8$
$$2y = 8 + 4x$$
$$y = 4 + 2x$$

For each:
✓ plots y-intercept
✓ draws accurate line (gradient)

−1 if no ruler or arrows

b) For each linear equation, state the below.

i) $y = -x + 2$

Gradient ___−1___ ✓

Y-intercept __(0, 2)__ ✓
(as a co-ordinate)

ii) $-4x + 2y = 8$

Gradient ___2___ ✓

X-intercept __(−2, 0)__ ✓
(as a co-ordinate)

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Question 3 [2 marks]

Show working to determine whether or not the point (4, 9) will lie on the line $y = -4x - 7$.

$y = -4(4) - 7$
$= -16 - 7$
$= -23 \neq 9$

✓ substitutes value into eqn & solve

Point (4, 9) does <u>not</u> lie on line

✓ concludes does not lie on line <u>with</u> <u>working</u>

Question 4   [3 marks]

Find the equation of the straight line that passes through the two points (2, -1) and (7, -16).

$m = \dfrac{-16 - (-1)}{7 - 2} = \dfrac{-15}{5} = -3$

✓ finds gradient

$y = -3x + C$
$-1 = -3(2) + C$
$-1 = -6 + C$
$5 = C$

✓ finds y-intercept

$y = -3x + 5$

✓ states equation of line

Question 5   [6 marks: 3, 3]

Solve the following simultaneous equations algebraically:

a) $x = 2y + 2$
      $x + y = 8$

b) $2x - 4y = 8$ ①
      $x - 3y = 3$ ②

For each:
✓ shows process of substitution or elimination
✓ solves one variable
✓ solves two variable

Substitution

$2y + 2 + y = 8$ $x = 2 \times 2 + 2$
$3y + 2 = 8$ $= 6$
$3y = 6$
$y = 2$

$x = 6$ or $(6, 2)$
$y = 2$

elimination

$\begin{array}{r} x - 2y = 2 \\ -\quad x + y = 8 \\ \hline -3y = -6 \\ y = 2 \end{array}$

$x = 2 \times 2 + 2$
$= 6$

$x = 6$
$y = 2$

elimination

$2 \times$ ② $2x - 6y = 6$

$\begin{array}{r} 2x - 4y = 8 \\ -\quad 2x - 6y = 6 \\ \hline 2y = 2 \\ y = 1 \end{array}$

$x = 6$ or $(6, 1)$
$y = 1$

$x - 3 \times 1 = 3$
$x - 3 = 3$
$x = 6$

Substitution

$x = 3 + 3y$
$= 3 + 3$
$x = 6$

$2(3 + 3y) - 4y = 8$
$6 + 6y - 4y = 8$
$6 + 2y = 8$
$2y = 2$
$y = 1$

$x = 6$
$y = 1$

END OF TEST

⑪

Name: _Solutions_

Teacher: Day   Friday   Hill   Kelly   Loh   Staffe

CALCULATOR ASSUMED

Materials allowed: One A4 page of notes (both sides), calculator(s),
Formula sheet
Show full working to obtain full marks for each of the questions in this section.

CF	/24
CA	/40
Units Deduction	
Total	/64

Time: 35 minutes

Question 6 [8 marks: 4,4]
For the following situations, define an unknown variable, write an equation, then use it to solve the problem.

a) The length of a rectangle is three times the width of the rectangle, and the perimeter is 48cm. Determine the area of the rectangle.

Let w = width of rectangle ✓defines variable

width is 6cm & length is 18 cm

$2w + 2(3w) = 48$ ✓writes equation
$8w = 48$
$w = 6$ ✓solves

∴ area is $6 \times 18 = 108 \text{ cm}^2$ ✓determines area

b) Joshua is six years older than his sister Peta. Four years ago, Joshua was twice her age. How old is Joshua now?

Let x = Joshua's current age ✓defines variable

	Joshua	Peta
now	x	$x-6$
4 years ago	$x-4$	$x-10$

✓equation
$x - 4 = 2(x-10)$
$x - 4 = 2x - 20$
$16 = x$
$x = 16$ ✓solves

Joshua is 16 years old.

✓answers in context

or y = Peta's current age

	Peta	Josh
now	y	$y+6$
4 yrs ago	$y-4$	$y+2$

$2(y-4) = y+2$
$2y - 8 = y + 2$
$y = 10$

(only 3 marks each if uses 2 variables)

⑧

Question 7 [4 marks]

For the following situation, define two unknown variables, write a pair of equations, then use it to solve the problem.

An Uber fare is made up of an initial fixed cost known as the flag-fall and a charge per kilometre travelled. Trevor travelled 8km by taxi to his friend's place for a cost of $18.50. Later that day he travelled 12km from his friend's place to the airport at a cost of $26.50. Determine the flag-fall and the cost per kilometre.

Let f = flagfall cost   ✓ defines variable

Let K = charge per Kilometre

$8K + f = 18.50$ ✓ writes x2 equation
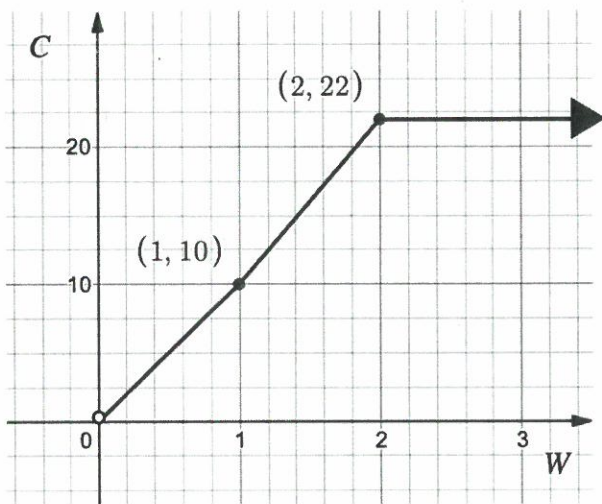$12K + f = 26.50$

$f = 2.50$
$K = 2$

✓ solves both variable

Flagfall cost is $2.50
and cost per kilometre
is $2.00.   ✓ answer in context

Question 8 [10 marks: 4, 3, 3]

Pamela is looking to send a number of parcels to the Northern Territory from Perth. One option is to use a private postal company, ZoTracking. The rates for ZoTracking are shown in the piece-wise function below.

$\dfrac{22-10}{2-1} = \dfrac{12}{1}$

$y = 12x + c$
$10 = 12(1) + c$
$-2 = c$

a) Complete the piece-wise function that describes the Cost, C dollars, of sending a parcel weighing W kg with ZoTracking.

$$C = \begin{cases} 10W, & 0 < W \le 1 \\ 12W - 2, & 1 < W \le 2 \\ 22, & W > 2 \end{cases}$$

states correct equation ✓   states correct domain ✓

or $1 < W < 2$
    $W \ge 2$

The postage costs, using another company, ExpressBlue, are shown in the following table.

Weight of Parcel (W kg)	Cost ($C)
$0 < W \leq 0.5$	5
$0.5 < W \leq 1$	8
$1 < W \leq 2$	16
$2 < W \leq 2.5$	22
$W > 2.5$	24

b) Represent this information in a step graph.
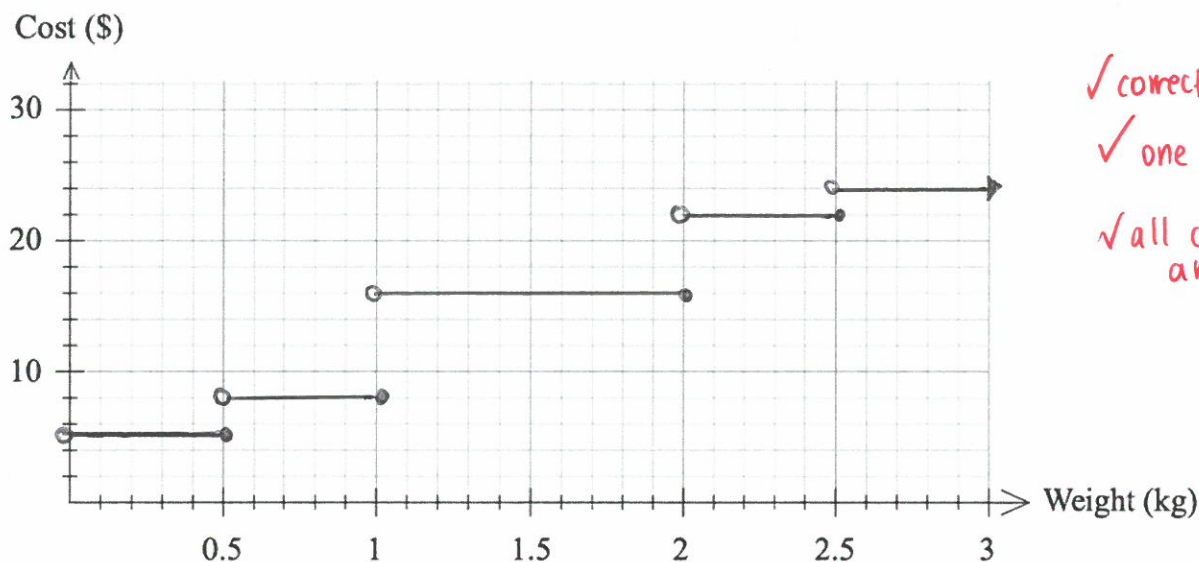
✓ correct nodes

✓ one segment correct

✓ all correct with arrow on >2.5

c) Pamela has two parcels to post to the Northern Territory, one to Alice Springs and the other to Darwin. One parcel weighs 750g and the other weighs 2.5kg. Provide a recommendation on which postal company Pamela should use. Justify your answer.

Zo Tracking

750g $10 \times 0.75 = \$7.50$

2.5kg $22

$29.50 ✓ calculates Zo Tracking

Express Blue

$8

$22   (not $24)

✓ calculates Express Blue

$30.00

Pamela should use Zo Tracking as it is cheaper by 50 cents.
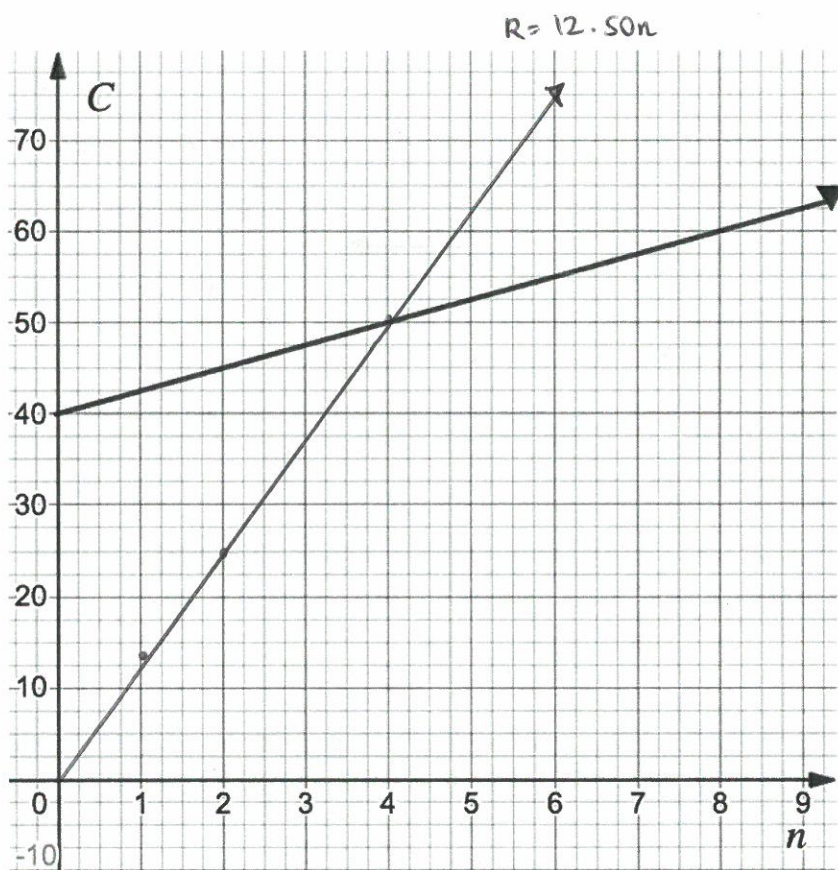
✓ recommendation

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Question 9 [9 marks: 1, 2, 3, 3]

Yolanda sells handmade bracelets at a market for $12.50.

a) Determine the equation to represent the revenue, R, for selling n bracelets.

$R = 12.50n$ ✓ answer

b) The cost to make n bracelets is represented by the equation C = 40 + 2.50n, as plotted below. Plot the equation, R, on the same axes.

R = 12.50n

C = 40 + 2.50n

Points (1, 12.50)
        (2, 25)
        (4, 50)

✓ correct gradient plotted
✓ correct y-intercept plotted
            (0,0)

−1 if no ruler or arrows

c) Using the graph, determine the point of intersection. In the context of this problem, interpret your solution.

Intersection is (4, 50) ✓ intersection identified
This is the breakeven point, Yolanda must sell 4 / ✓ states 4 bracelet
bracelet to breakeven (cost = revenue or profit = 0)
✓ breakeven
cost = revenue (interpretation)
profit = 0

d) If Yolanda sells 13 bracelets, calculate the profit or loss she makes. Justify your answer with evidence.

$R = \$162.50$
$C = \$72.50$

Yolanda will make a profit
of $90.

✓ calculates profit
✓ calculates cost
✓ states profit value

⑨

Question 10 [9 marks: 3, 2, 2, 2]

A large fish tank is being filled with water. After 2 minutes the height of the water is 3 cm and after 5 minutes the height of the water is 4.5 cm. The height of the water, h, in centimetres after t minutes can be modelled by a linear relationship.

a) Determine the equation to represent the height of the water, h, after t minutes.

$(2,3)$ $(5, 4.5)$

$$m = \frac{4.5-3}{5-2} = \frac{1.5}{3} = \frac{1}{2} \quad \checkmark \text{calculates gradient}$$

$h = \frac{1}{2}t + c$

$3 = \frac{1}{2}(2) + c$

$3 = 1 + c$

$2 = c$ $\checkmark$ finds y-intercept

$h = \frac{1}{2}t + 2$

or

$h = 0.5t + 2$ $\checkmark$ determines equation with variables h & t

b) In the context of this problem, what does the gradient represent?

For each minute, the water height is increasing by 0.5cm

$\checkmark$ states increasing
$\checkmark$ explains in context (height ↑)

c) Determine how long it takes for the water to reach 6 centimetres

$h = 6$ $6 = \frac{1}{2}t + 2$ $\checkmark$ substitutes $h = 6$

$t = 8$ 8 minutes $\checkmark$ solves with answer

d) Was the fish tank empty of water before the filling of the tank started? Justify your answer.

No, the fish tank was not empty.

when $t = 0$ (before filling started) the height was 2cm of water so it was not empty.

$\checkmark$ no (with reason)
$\checkmark$ appropriate justification

END OF TEST

⑨