MARKING KEY

# ROSSMOYNE SHS SEMESTER 1, 2009

# UNIT 2C MATHEMATICS EXAMINATION

# SECTION B APPROVED CALCULATORS PERMITTED

STUDENT'S NAME _____

TEACHER:-
(Circle one name) KNOBLAUCH LONGLEY SUTTON TAY

TIME ALLOWED FOR THIS PAPER

| | |
|---|---|
| Reading time before commencing Section A | Five minutes |
| Working time for Section A (non calculator) | Forty minutes |
| Changeover time between Sections A and B | Five minutes |
| **Reading time before commencing Section B** | **Five minutes** |
| **Working time for Section B** | **Eighty minutes** |

| | |
|---|---|
| Available marks for Section A: | 40 marks |
| Available marks for Section B: | 80 marks |

**MATERIAL REQUIRED / RECOMMENDED FOR THIS PAPER**
TO BE PROVIDED BY THE SCHOOL:
This Question/Answer booklet
TO BE PROVIDED BY THE CANDIDATE

| | |
|---|---|
| *Standard Items* | Pens, pencils, eraser, ruler |
| *Special items* | Curriculum Council Mathematical Formulae and Statistics Tables Book, drawing instruments, templates, notes on two sheets (4 sides) of A4 paper and calculators (Section B only) satisfying the conditions set by the Curriculum Council. |

NOTE: Personal copies of the Tables Book should not contain any handwritten notes, symbols, signs, formulae or any other marks (including underlining and highlighting), except the name and address of the candidate, and may be inspected during the examination.

**IMPORTANT NOTE TO CANDIDATES**

**No other items may be taken into the examination room.**
**It is your responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor BEFORE reading any further.**

# SECTION B

## APPROVED CALCULATORS PERMITTED FOR THIS SECTION

TIME: 80 minutes
MARKS ALLOCATED 80 marks

**Question 1. [ 6 marks ]**

a) The points $A(1,a)$ and $B(b,18)$ lie on the line $y=5x-2$.

i. Determine the values of $a$.

[ 2 ]

$a = 5(1) - 2$ ✓

$a = 3$ ✓

ii. Determine the values of $b$.

[ 2 ]

$18 = 5b - 2$ ✓

$b = 4$ ✓

b) Find the equation of the straight line through the point $(2,5)$ and parallel to the line with equation $y=4x+11$

[ 2 ]

$y = 4x + c$

2, 5 $5 = 4(2) + c$ ✓

$c = -3$

equation is $y = 4x - 3$ ✓

**Question 2.** **[ 8 marks ]**

a) Find the equation of the line through the point (12,3) which is perpendicular to the line $y = 4x - 5$. [ 3 ]

$y = -\frac{1}{4}x + c$ ✓

12, 3 $\quad 3 = -\frac{1}{4}(12) + c$

$c = 6$ ✓

equation is $y = -\frac{1}{4}x + 6$ ✓

b) What is the gradient of the line which passes through the points $A(17, 8)$ and $B(-13, 24)$ [ 2 ]

$m = \frac{24-8}{-13-17}$ ✓

$= \frac{-16}{30}$ ✓

$= -0.5\overline{3}$

c) What is the distance between A and B? [ 3 ]

distance $= \sqrt{16^2 + 30^2}$ ✓✓

$= 34$ ✓

**Question 3**

For the

State

a)

he

[ 3 ]

**Question 3.** **[ 8 marks ]**

For the graph $y = 2(x+5)^2 - 3$

State

a) the equation of the line of symmetry [ 2 ]

$x = -5$ ✓✓

b) Whether $y$ has a maximum or minimum value [ 2 ]

minimum ✓✓

c) The co-ordinates at the maximum or minimum value of $y$ [ 2 ]

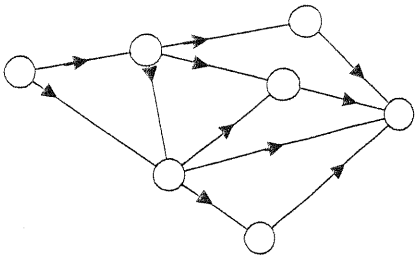
$(-5, -3)$ ✓✓

d) The coordinates of the point where the graph crosses the $y$ axis [ 2 ]

$(0, 47)$ ✓✓

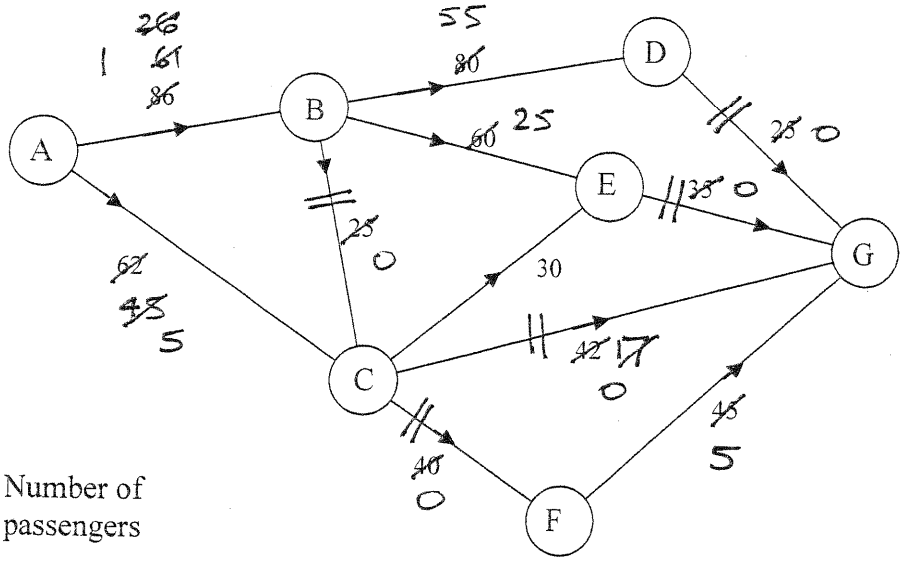
**Question 4.** **[ 9 marks ]**

Littleknown Airways has a network of destinations as shown in the diagram.



a) Consider the diagram below. The **number of passengers** that can be carried on each route is shown on each arc. The arrow shows the direction of travel. What is the maximum number of people that can fly from A to G? [Show working]

[ 5 ]




method ✓✓

| | |
|---|---|
| ABDG | 25 |
| ABEG | 35 |
| ABCG | 25 ✓ |
| ACG | 17 |
| ACFG | 40 |
| | 142 |

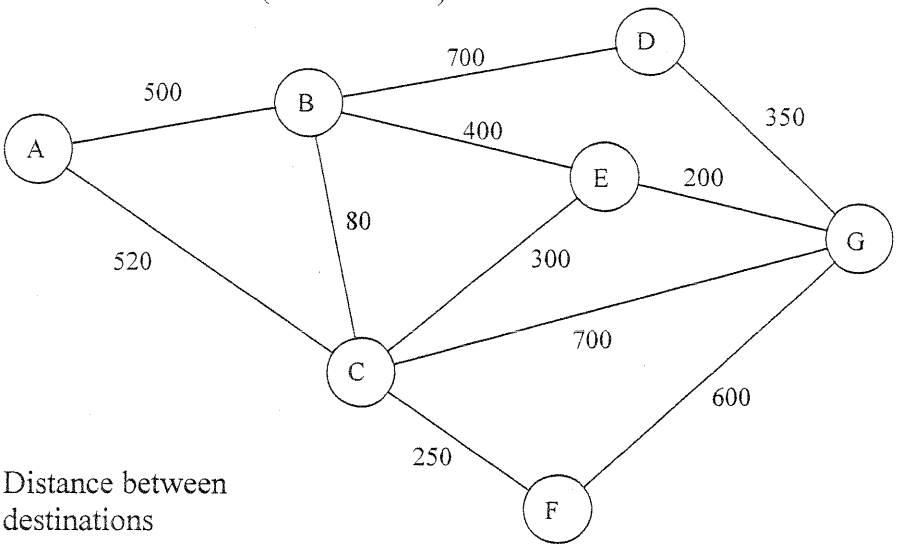
max flow 142 passengers ✓✓

b) A new plane is purchased so that from A to C, the number of passengers is increased to 100. What effect on the number of passengers able to travel from A to G

[ 2 ]

no effect ✓✓

The diagram shows the distances (in kilometres) for each route.

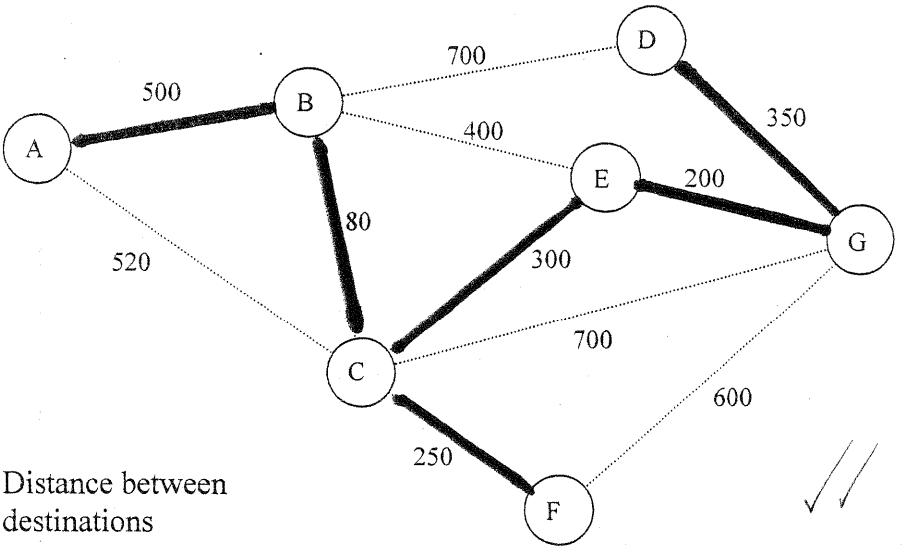



Distance between destinations

Littleknown Airways is bought out by a new company. The new company decides that it can only maintain those links between towns that form a minimal spanning tree.

c) Draw the minimal spanning tree on the diagram below.

[ 2 ]




Distance between destinations

**Question 5.** **[ 8 marks ]**

For the graph $y = -2(x-3)(x+5)$

State

a) the equation of the line of symmetry

[ 2 ]

$x = -1$ ✓✓ R/W

b) Whether y has a maximum or minimum value

[ 2 ]

maximum ✓✓ R/W

c) The coordinates of the point where the graph crosses the $y$ axis

[ 2 ]

$(0, 30)$ ✓✓ R/W

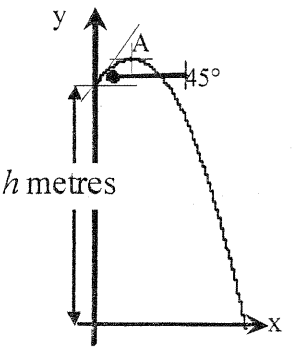
d) The coordinates of the point(s) where the graph crosses the $x$ axis

[ 2 ]

$(-5, 0)$ & $(3, 0)$ ✓✓ R/W

**Question 6.** **[ 6 marks ]**

The diagram on the right shows the motion of a stone thrown out to sea from the top of a cliff. The stone has an initial speed of 8m/s at 45° to the horizontal, from a position that is $h$ metres above sea level. The equation of the path of the particle is $y = -0.2(x-2.5)^2 + 12.5$ with $x$ and $y$ axes as shown in the diagram and 1 metre to 1 unit on each axis.




Find

a) the coordinates of A, the highest point on the path of the particle,

[ 2 ]

(2.5, 12.5) ✓✓

b) the value of $h$.

[ 2 ]

h = 11.25 ✓✓

c) How far is the stone out to sea when it splashes down?

[ 2 ]

10.405

≈ 10.4 m ✓✓

**Question 7. [ 9 marks]**

Two 4 sided unbiased spinners are both numbered 2, 4, 5 and 8.

a. Complete the table below which shows the possible outcomes when the two spinners are spun.

[ 1]

BLUE

| | SPINNER | | | |
|---|---|---|---|---|
| RED SPINNER | 2 | 2, 2 4 | 4, 2 6 | 5, 2 7 | 8, 2 (10) |
| | 4 | 2, 4 6 | 4, 4 8 | 5, 4 9 | 8, 4 12 |
| | 5 | 2, 5 7 | 4, 5 9 | 5, 5 (10) | 8, 5 13 |
| | 6 | 2, 6 8 | 4, 6 (10) | 5, 6 11 | 8, 6 14 |

Let A be the event that the Red Spinner is 2.
Let B be the event that the sum of the two spinners is 10.
Let C be the event that the Blue Spinner is 8.

b. Calculate

i) $P(A)$ $\frac{4}{16} = 0.25$ ✓✓

[ 2 ]

ii) $P(B)$ $\frac{3}{16}$ ✓✓

[ 2 ]

iii) $P(A \cap C)$ $\frac{1}{16}$ ✓✓

[ 2 ]

iv) $P(B \mid A)$ $\frac{1}{4}$ ✓✓

[ 2 ]

**Question 8.** **[ 10 marks ]**

a) In a study to find the relationship between hypertension and smoking habits the following data was collected.

| | Non-smoker | Smoker | TOTAL |
|---|---|---|---|
| Hypertension | 21 | 66 | 87 |
| No hypertension | 48 | 45 | 93 |
| TOTAL | 69 | 111 | 180 |

If an individual from the study is selected at random, calculate the probability that the person is

i. suffering from hypertension given that the person is a smoker. [2]

66/111 ✓✓ fit from table

ii. a non-smoker who does not suffer from hypertension. [2]

48/180 ✓✓ fit from table

b) In another study, this time of 300 people, the following information was collected.

- Exactly half the people suffered from hypertension
- The probability that a person suffering from hypertension is a non smoker is 0.20
- The probability that a non-smoker suffers from hypertension is 0.30

Use the information above to complete the table [4]

| | Non-smoker | Smoker | TOTAL |
|---|---|---|---|
| Hypertension | 120 | 30 | 150 ✓ |
| No hypertension | 80 | 70 | 150 ✓ |
| TOTAL | 200 ✓ | 100 ✓ | 300 |

c) Comment on the statement "In the second study a greater proportion of non-smokers are suffering from hypertension". [2]

2nd survey 120/200 = 0.3 ✓

1st survey 21/69 = 0.304 ✓

Comment ~~true~~ False.

**Question 9.** **[ 6 marks ]**

**a)** Percy bought a car 5 years ago for $35000 and expected that its value will decrease a steady rate of 8% p.a. He is now selling it. Assuming that his assumptions are correct, how much can he expect to get for it?

[ 3 ]

$A = 35000 \times 0.92^5$

$= \$23067$

$\approx 23000$ ///

**b)** Unfortunately, Percy's care of his car was not good and the best offer was $15000. What steady annual rate of depreciation does this drop in initial value represent?

[ 3 ]

$15000 = 35000 \times r^5$

$r = 0.84$

depreciation rate is 15.6% p.a ///

**Question 10.** **[ 6 marks ]**

**Tax rates 2008-09**

| *Taxable income* | *Tax on this income* |
|---|---|
| $0 – $6,000 | Nil |
| $6,001 – $34,000 | 15c for each $1 over $6,000 |
| $34,001 – $80,000 | $4,200 plus 30c for each $1 over $34,000 |
| $80,001 – $180,000 | $18,000 plus 40c for each $1 over $80,000 |
| $180,001 and over | $58,000 plus 45c for each $1 over $180,000 |

The Australian government's personal income tax charges appear in the above table.

a) How much tax does a person with a taxable income of $60570 pay? [ 3 ]

tax : 4200 + 0.3 × (60570 − 34000) ✓

= $12171 ✓✓

b) How much will this person "take home" each week"? [ 3 ]

net : 60570 − 12171 ✓

= 48399

weekly : 48399/52 ✓

= $930.75 ✓

**Question 11.** **[ 4 marks ]**

A loan of $25000 is taken with compound interest charged at 9.5% p.a. compounded monthly.

a) Use the financial application in your calculator to find how much needs to be paid each month to repay this loan in 4 years.

[ 2 ]

$ 628.08 ✓✓

b) What is the total amount of interest charged for this loan?

[ 2 ]

total repay = 48 × 628.08

= 30 147.84 ✓

interest = 30 147.84 − 25 000

= $ 5 147.84 ✓