NAME: _____

MAKE SURE YOU KNOW HOW TO COMPLETE THESE QUESTIONS!

Part C This part of the examination consists of **Questions 11 to 16**.

For each question, you must show all your work to justify your answer. The work you show on all the pages of Part C will be considered.

Your work must be organized and clearly presented; it cannot simply involve listing the calculator applications or programs used to obtain results or information.

Each question in Part C is worth 10 marks.

TOPIC 1: OPTIMIZATION

11. Body Builders

Cody works out at *Body Builders* where there are different weight machines to exercise the arms and the legs. He creates a workout routine that involves:

- a maximum of 24 exercises $x+y \leq 24$
- at least 4 arm exercises $x \geq 4$
- no fewer than 6 leg exercises $y \geq 6$
- at most twice as many leg exercises as arm exercises $y \leq 2x$

y 2x

Cody's routine has 25 repetitions of each arm exercise and 30 repetitions of each leg exercise corresponding to the rule: $Z = 25x + 30y$.

What is the maximum possible number of repetitions in Cody's exercise routine?

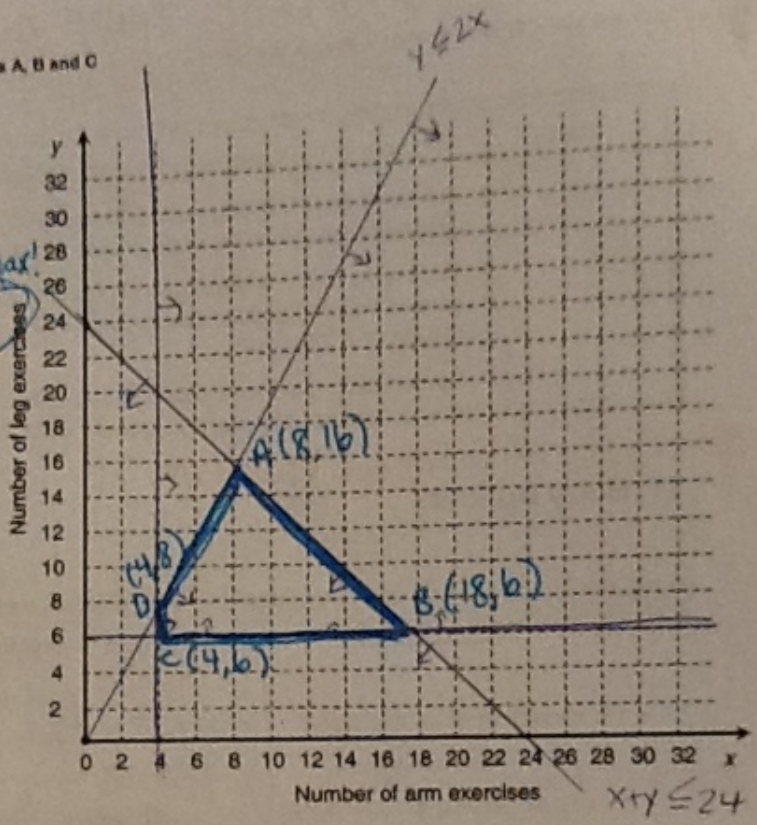
→ Let x: the number of arm exercises

→ Let y: the number of leg exercises

Show all your work.

	$Z = 25x + 30y$	Z
A(8,16)	$25(8) + 30(16)$ $200 + 480$	680
B(18,6)	$25(18) + 30(6)$ $450 + 180$	630
C(4,6)	$25(4) + 30(6)$ $100 + 180$	280
D(4,8)	$25(4) + 30(8)$ $100 + 240$	340

max!



The maximum possible number of repetitions in Cody's exercise routine is 680.

Uses mathematical reasoning							
		Observable indicators correspond to level					
Evaluation Criteria	LEVEL	A	B	C	D	E	
	Cr. 3	40	32	24	16	8	0
	Cr. 2	40	32	24	16	8	0
	Cr. 4 Cr. 5	20	16	12	8	4	0

TOPIC 4: PROBABILITY (Voting Procedures)

Compute the winner of the election using each of the methods provided. Show your work.

Votes		16	14	17	13
1st choice	2	A	C	B	C
2nd choice	1	B	A	A	B
3rd choice	0	C	B	C	A

Total votes = 16+14+17+13 = 60

majority: 1 person with over 50% of the votes

Winner by majority ballot: Would need 31 votes

A: 16 B: 17 C: 14+13 = 27

NO winner.

plurality: person with the most first place votes

Winner by plurality ballot:

C is the winner with 27 votes.

Borda's: Number values

Winner by Borda's method:

A: 2(16) + 1(14+17) + 0(13) = 32 + 31 + 0 = 63

B: 2(17) + 1(16+13) + 0(14) = 34 + 29 + 0 = 63

C: 2(14+13) + 1(0) + 0(16+17) = 54 + 0 + 0 = 54

NO winner

Condorcet's: A vs B, A vs C, B vs C

Winner by Condorcet's criterion:

			winner
A vs B:	A: 16+14 = 30	B: 17+13 = 30	Tie
A vs C:	A: 16+17 = 33	C: 14+13 = 27	A
B vs C:	B: 16+17 = 33	C: 14+13 = 27	B

NO winner

Elimination: - Take out the person with the least 1st place votes and give those votes to their 2nd choice

Winner by elimination method:

1st place votes:

A: 16

B: 17

C: 27

A has the least because it only has 16. So those votes go to the 2nd place in that column (below) → B.

B has 17+16 = 33

C has 27

B is the winner

TOPIC 2: GRAPH THEORY

Sam is planning a trip to Alberta, where he will be visiting cities A, B, C and D. To get from one city to another, he will travel by bus or by train. The following table shows the cost of getting from one city to another depending on the mode of transportation.

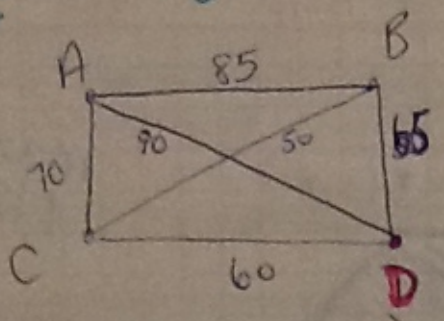
TRAVEL BETWEEN CITIES	BUS FARE	TRAIN FARE
A and B	$85	$90
A and C	$85	$70
A and D	$90	—
B and C	$50	—
B and D	$65	$75
C and D	—	$60

Step 1: So we look at the cheapest option for each path

Sam will begin and end his trip in City D.

What are Sam's total minimum travel expenses?
Show all your work.

Step 2: Draw your graph.



Step 3: Look at possible routes:

DBACD 65+85+70+60 = 280
DBCAD 65+50+70+90 = 275
DCBAD 60+50+85+90 = 285
DABCD 90+85+50+60 = 285
DACBD 90+70+50+65 = 275

Note there are a few other routes but they are just the backwards version of another

Minimum is $275

#7 Easy Complete

TOPIC 1: OPTIMIZATION

A fisherman has to separate his daily catch of shellfish into two categories, lobsters and crabs, before he can sell them. Lobsters are sold for $8.70 each and crabs are sold for $9.60 each.

$R = 8.70x + 9.60y$

On an average day, the fisherman can expect to catch a minimum of 35 crabs and a maximum of 60. By experience, there are at most twice as many lobsters as crabs in a daily catch and never has the fisherman caught more than 140 shellfish in a single day.

x = lobster
y = crab

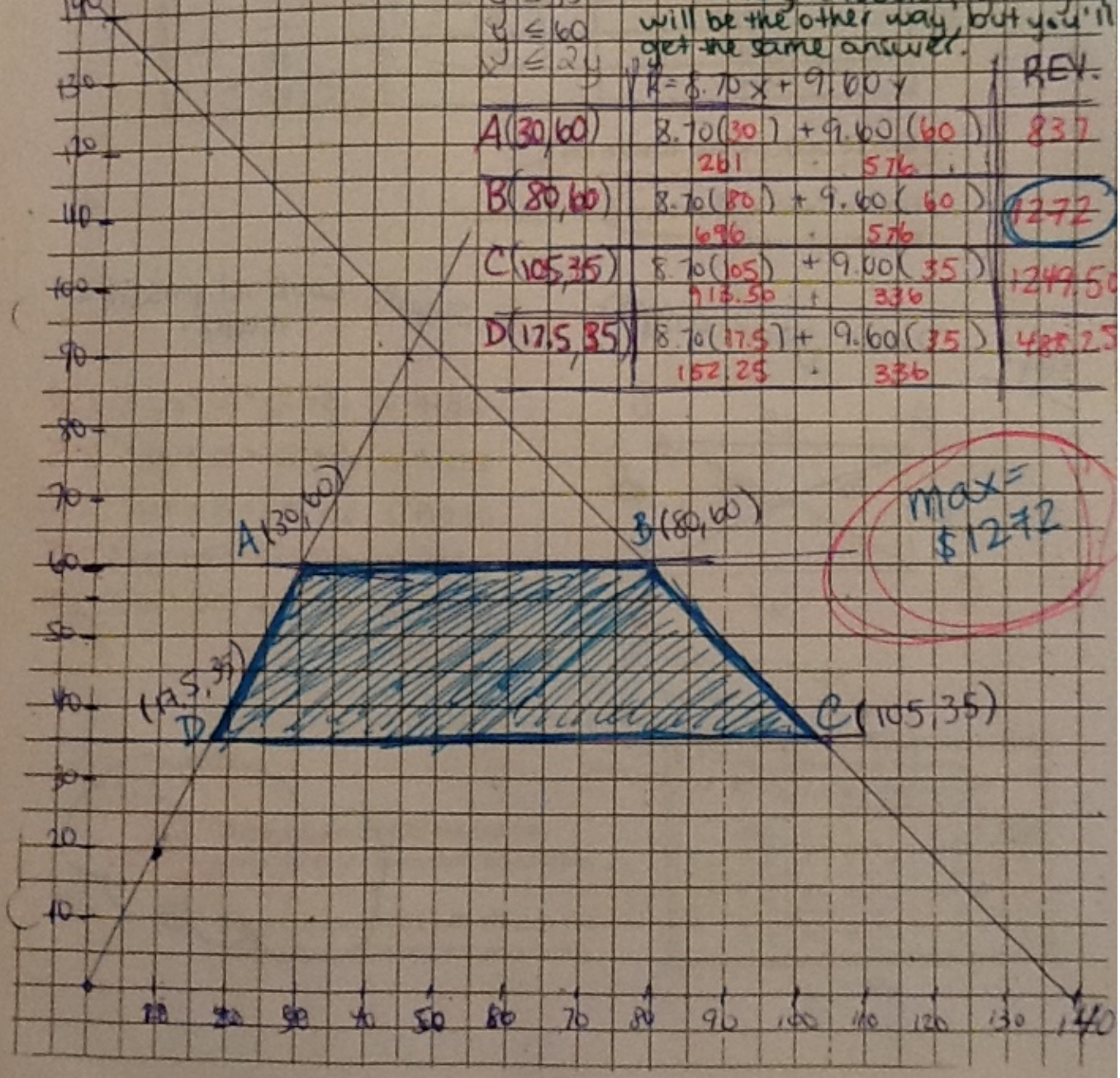
Using a polygon of constraints, determine the maximum revenue that this fisherman can expect to make.

Show me polygon, vertices, inequalities & maximum.

$x + y \leq 140$
$y \geq 35$
$y \leq 60$
$x \leq 2y$

NOTE: If you did x as crab and y is lobster, your graph will be the other way, but you'll get the same answer.

	$R = 8.70x + 9.60y$	REV.
A(30,60)	8.70(30) + 9.60(60) = 261 + 576	837
B(80,60)	8.70(80) + 9.60(60) = 696 + 576	1272
C(105,35)	8.70(105) + 9.60(35) = 913.50 + 336	1249.50
D(17.5,35)	8.70(17.5) + 9.60(35) = 152.25 + 336	488.25



max = $1272