

11. WHALE WATCHING

TOPIC 1: OPTIMIZATION

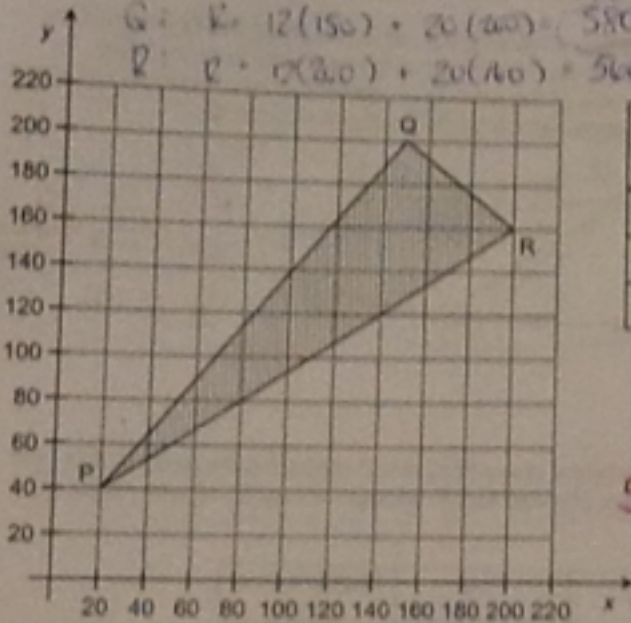
Larry organizes whale watching cruises over the summer. There is a cruise in the morning and a cruise in the afternoon.

Polygon of constraints PQR below is based on the constraints that apply to each cruise.

$$P: R = 12(20) + 20(40) = 1040$$

$$Q: R = 12(150) + 20(200) = 5800$$

$$R: R = 12(200) + 20(160) = 5600$$



COORDINATES OF THE VERTICES OF THE POLYGON OF CONSTRAINTS
P(20, 40)
Q(150, 200)
R(200, 160)

5800
← max

$$R = 12x + 20y$$

$$5220 = 12(150 + 10) + 20y$$

$$5220 = 12(160) + 20y$$

$$3300 = 20y$$

$$165 = y$$

where x : number of child passengers on the boat, per cruise

y : number of adult passengers on the boat, per cruise

$$R = 12x + 20y$$

For each cruise, Larry charges \$12 per child passenger and \$20 per adult passenger.

Larry maximized his revenue on this morning's cruise.

Larry's revenue from this afternoon's cruise was \$5 220. There were 10 more child passengers on board this afternoon than there were this morning.

How many adult passengers were on this afternoon's cruise?

y

165

12. Two Dishes

TOPIC 2: GRAPH THEORY

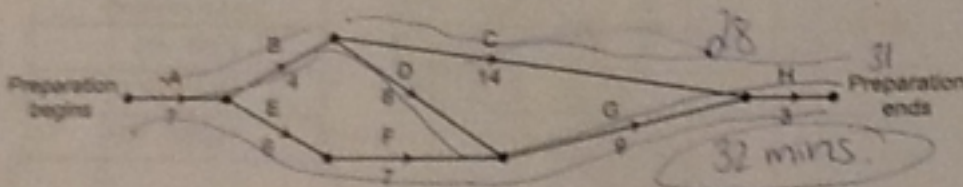
Amelia is a culinary student. She must prepare two dishes for an exam.

The minimum time required to prepare each dish is the same.

- We will go over this one in class in detail

FIRST DISH

The graph below shows the different steps involved in preparing the first dish. The value on each edge indicates the number of minutes required to complete the corresponding step. The direction of the arrows indicates the order in which the steps must be completed. Several steps can be carried out at the same time.

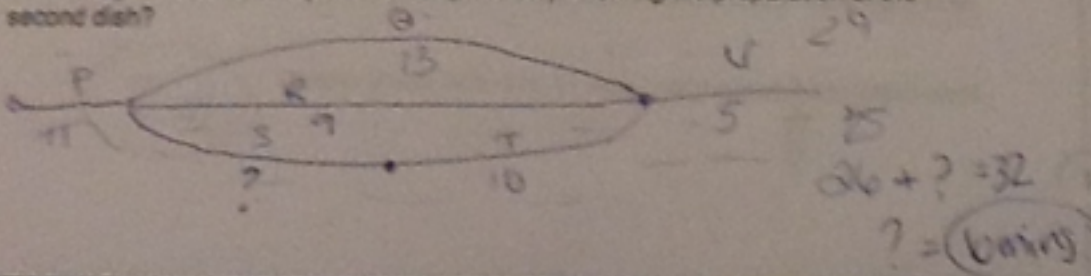


SECOND DISH

The table below shows the different steps involved in preparing the second dish, the time required to complete each of these steps, except for step S, as well as the prerequisite step or steps.

STEP	TIME (MINUTES)	PREREQUISITE STEP(S)
P	11	None
Q	13	P
R	9	P
S	7	P
T	10	S
U	5	Q, R and T

How many minutes are required to complete step S during the preparation of the second dish?



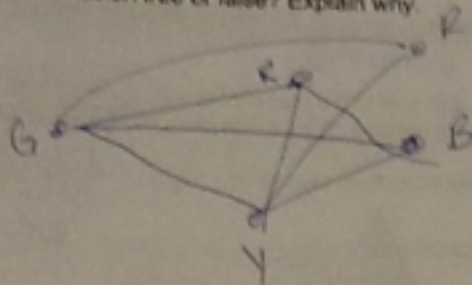
13. CHROMATIC NUMBER

TOPIC 2: GRAPH THEORY

After comparing several graphs, Jordan drew the following conclusion:

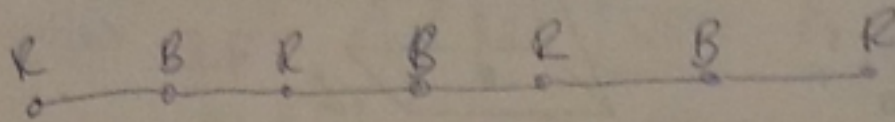
The greater the number of vertices in a graph, the greater the chromatic number of the graph.

Is Jordan's conclusion true or false? Explain why.



Chrom = 5

5 vert.



7 vert

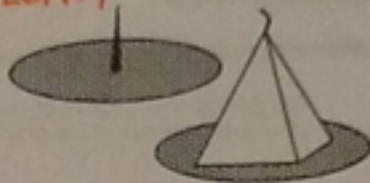
Chrom = 2.

\therefore false.

14. CANDLE MAKING

TOPIC 5: EQUIVALENCY

Rosalie makes decorative candles. To make sure each candle stays in place, she puts it on a candleholder with a spike.

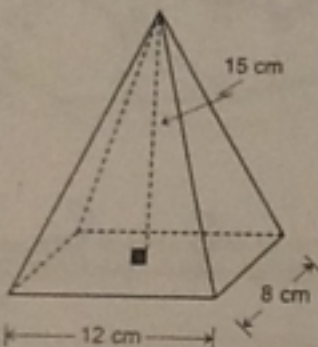


The shape of her candles is different each year. All the candles she designs are equivalent solids.

Same Volume

Each candle she designed last year was in the shape of a right pyramid with a rectangular base. Its height and the lengths of the sides of its base are indicated below.

CANDLE DESIGNED LAST YEAR



$$Vol = \frac{1}{3}(15)(12)(8)$$

$$= 480 \text{ cm}^3$$

Cube:

$$\sqrt[3]{480} = \text{edge}$$

$$7.83 = \text{edge}$$

Sphere:

$$Vol = \frac{4\pi r^3}{3}$$

$$480 = \frac{4\pi r^3}{3}$$

$$114.59 = r^3$$

$$4.86 = r$$

Rosalie is trying to decide whether this year's candles will be in the shape of a sphere or in the shape of a cube. Since she wants to varnish the entire surface of the candles, she must design them in the shape that will enable her to use the least amount of varnish.

lowest surface area

In what shape will Rosalie design her candles this year?

$$Area = 4\pi r^2$$

$$= 4\pi(4.86)^2$$

$$= 296.47$$

Sphere

$$S.A = 6(7.83)(7.83)$$

$$= 367.83$$

15. PETER'S FILM COLLECTION

TOPIC 4: PROBABILITY

Over the past few years, Peter has been collecting two types of films: action films and thrillers. The films in his collection are on either DVD or Blu-ray. Below is some information about his collection.

- There are 72 thrillers in his collection.
- There are 63 films on DVD.
- A film is randomly selected. Given that it is a thriller, the probability that it is on DVD is $\frac{2}{3}$.
- A film is randomly selected. Given that it is on Blu-ray, the probability that it is a thriller is 40%.

How many more thrillers than action films does Peter have in his collection?

	Action	Thriller	T
DVD	15	$x = 48$	63
B.R.	36	24	$y = 60$
T	51	72	123

$$\frac{x}{72} = \frac{2}{3}$$

$$x = 48$$

$$\frac{24}{y} = \frac{40}{100}$$

$$y = 60$$

$$72 - 51 = 21$$

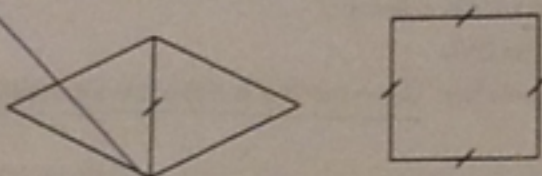
21 more thrillers than action.

16. EQUIVALENT POLYGONS

* Don't do this question -
we no longer cover this in
grade 11!

Consider the type of rhombus described below.

The short diagonal of the rhombus is congruent to the sides of the square that is equivalent to this rhombus.



Formulate a conjecture describing the relationship between the length of the long diagonal and the length of the short diagonal for this type of rhombus.