

Name: \_\_\_\_\_  
Date: \_\_\_\_\_

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# GRADE 12 APPLIED

## UNIT G

### DESIGN AND MEASUREMENT

### WORKBOOK

#### EXTRACTS OF PAST PROVINCIAL EXAMS

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Manitoba Education and Training Winnipeg, Manitoba, Canada. The source of these extracts allows that: Permission is hereby given to reproduce this resource for non-profit educational purposes provided the source is cited.

Answers will vary for most questions! No answer key is attached with this document

**Students will be given all geometric formulae necessary**  
**You must SHOW YOUR WORK for each and every question**  
**(except multiple choice questions)**

#### GRADE 12 APPLIED

#### UNIT G – DESIGN AND MEASURE

#### EXTRACTS OF PAST EXAMS

**Manitoba Education and Training**  
**Winnipeg, Manitoba, Canada**

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Items in [ ... ] brackets are annotations by MrF

#### **DIRECTIONS**

Read all instructions on the test carefully.

If you need extra paper or you print out an answer to a question, let the teacher know. Indicate in the response space of the question that your answer is on a separate sheet.

Remember to:

- indicate your input values by writing them in your booklet or printing a copy if using a technology tool
- include your booklet number and question number on additional pages (e.g., printouts) and attach them to the corresponding page in the booklet
- express your answers in decimal and percentage form to the nearest hundredth (two decimal places) when rounding, unless otherwise indicated  
Example:  $15/29 = 0.52$  or  $51.72\%$
- state any assumptions you make

MRF

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**A clearly communicated answer:**

- is easily identified in the response space [ Box it! Label it with words!]
- includes the parameters in the equation, and “y =”, “sin”, “ln”, or “x”, as applicable [ie: write a complete equation ]
- includes the units of measure, where applicable
- includes labels, units, and scales for the axes on graphs
- is expressed as an exact value or is appropriately rounded [note: when calculating how many units of a product you need to buy like cans of paint, round up!]

Marks may be deducted for errors relating to any of the above.

**JAN 2013**

The Bertrands want to empty their circular swimming pool. There is 3 feet of water left in the pool which has a diameter of 16 feet. Using a pump which can remove 400 ft<sup>3</sup> of water per hour, how many hours will it take to remove all the water?

MRF

3

You have been asked to install floor tiles and paint your aunt's bathroom based on the following information:

- The floor measures 5 ft. × 7 ft.
- The walls are 8 ft. high.
- The door measures 80 in. × 30 in.
- The window measures 24 in. × 30 in.

- a) You must cover the entire bathroom floor with tiles. Each tile measures 1 ft. × 1 ft. You will need an extra 5% of tiles to account for waste. How many tiles will you need to purchase for the project?
- b) You must apply two coats of paint to the walls of the bathroom. The door and the window will not be painted. Determine the total area to be painted. How many cans of paint will you need to purchase if one can covers 100 ft<sup>2</sup>?

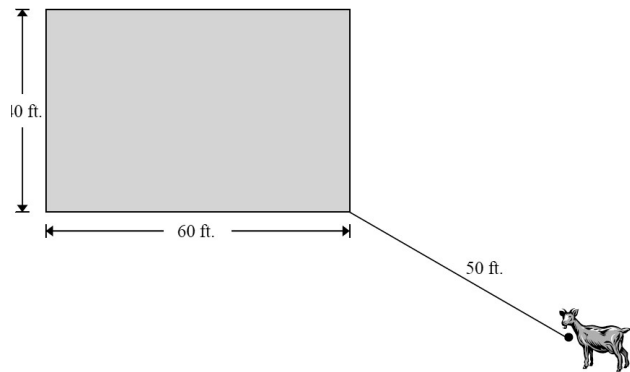
**JUN 2013**

The Reimers have purchased a house valued at \$250,000.00 and have made a down payment of \$25,000.00.

- a) Calculate their monthly mortgage payment if they obtain a mortgage amortized over 15 years at an interest rate of 5.50% compounded semi-annually.
- b) How much equity will the Reimers have in their house after 5 years if the value of the house appreciates at a rate of 2.00% per year?

A cake mix will produce 230 cubic inches of batter. You are using cylinder-shaped baking cups that have a diameter of 3 inches and a depth of 2 inches for the batter. How many cupcakes will you be able to make?

A goat is tied to the corner of a barn with a 50-foot rope. The barn measures 60 feet by 40 feet. Calculate the total area outside of the barn that is available to the goat.



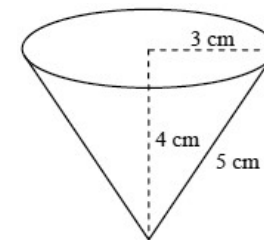
The Manitoba Beach Volleyball Association has asked you to design a souvenir beach ball according to the following information:

- The beach ball must have a volume between 1 and 3 cubic feet.
- The plastic material costs \$0.15 per  $\text{ft}^2$ .
- Labour and other materials cost \$1.25 per beach ball.
- The Association wants to make a profit of 80% of the cost of making each beach ball.

Based on your design, what is the minimum selling price for each souvenir beach ball?

**JAN 2014**

What is the minimum amount of paper required to create the cone-shaped paper cup shown at right? (Diagram is not drawn to scale.)



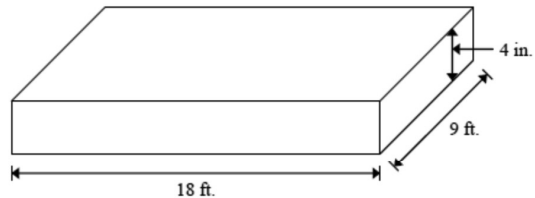
Select the correct answer.

- A)  $37.70 \text{ cm}^2$
- B)  $47.12 \text{ cm}^2$
- C)  $75.40 \text{ cm}^2$
- D)  $113.10 \text{ cm}^2$

MRF

6

A student was given the following diagram and was asked: "How many cubic yards of soil are required to fill this garden with 4 inches of soil?" (Diagram is not drawn to scale.)



The student provided this answer:  $18 \times 9 \times \frac{1}{3} = 54 \text{ ft}^3 = 18 \text{ ft}^3$

Explain the student's error and provide the correct answer.

A bathroom floor is covered by 15 floor tiles.

Each tile measures 18 in.  $\times$  18 in.

a) How many floor tiles measuring 6 in.  $\times$  6 in. would be needed to cover the same area?

b) You would like to redo the floor with 6 in.  $\times$  6 in. tiles. These tiles are sold in packages of 5 tiles and cost \$4.00 per package (taxes included). How much would it cost to buy the number of tiles you calculated in (a)?

MRF

JUN 2014

7

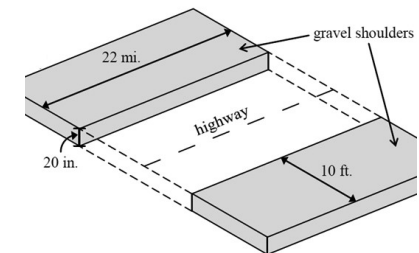
Philippa wants to cover her dining room floor with linoleum. The floor measures 14 ft.  $\times$  12 ft. The linoleum costs \$13.99 per square yard and must be purchased in whole units.

What will be the total cost for the flooring, including taxes? (Note: GST = 5%, PST = 8%)

Mackenzie Construction was awarded the contract to build gravel shoulders along the highway between Wabowden and Thompson.

The gravel shoulders will be:

- along a 22 mile segment of the highway
- on both sides of the highway
- 10 feet wide
- 20 inches deep



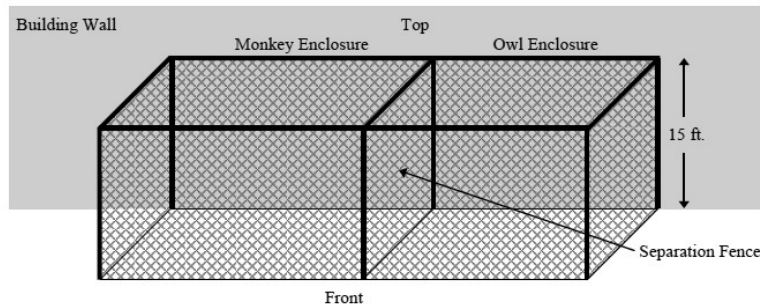
(Diagram is not drawn to scale.)

NOTE: 1 mile = 5,280 ft

How many truckloads of gravel will be needed for the project if a truck holds 20 cubic yards of gravel?

The zoo has asked you to design a structure for its monkeys and owls using the following guidelines:

- The structure will back against the wall of a building and will be fenced at the top, front, and sides. (No fence is needed on the ground or at the back.)
- The structure will be divided into two enclosures by a separation fence and have a height of 15 ft.
- The monkeys require an enclosure with a ground area between 600 ft<sup>2</sup> and 1000 ft<sup>2</sup>.
- The owls require an enclosure with a ground area between 400 ft<sup>2</sup> and 800 ft<sup>2</sup>.
- The entire structure will be created using chain-linked fence, which is sold in 50 ft. × 5 ft. (250 ft<sup>2</sup>) segments. Each segment costs \$160.00, plus GST and PST.



a) Determine a possible set of dimensions for your design.

Ground dimensions of monkey enclosure: \_\_\_\_\_ ft. × \_\_\_\_\_ ft.

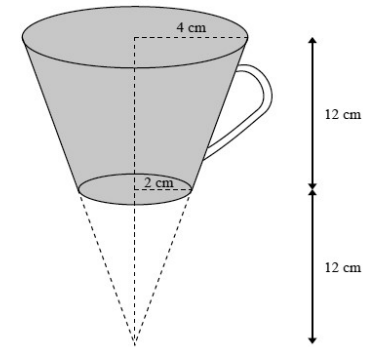
Ground dimensions of owl enclosure: \_\_\_\_\_ ft. × \_\_\_\_\_ ft.

b) Determine the minimum number of fence segments needed for your design.

c) Calculate the total cost of the structure. (Note: GST = 5%, PST = 8%)

The coffee mug shaded in the diagram below is based on a cone with the bottom portion removed. (Diagram is not drawn to scale.)

Determine the volume of the mug.



[a shape like this that has been chopped off is called a **frustrum**]

JUNE 2015

Select the best answer.

How many cubic yards are in 54 cubic feet?

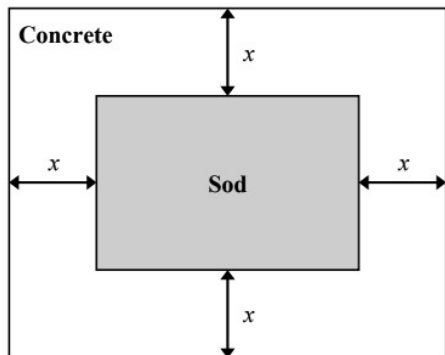
- A. 2    B. 3    C. 6    D. 18

One can of paint can cover an area of 200 ft<sup>2</sup>.

How many cans need to be purchased to paint a 60 ft. by 8 ft. wall?

[remember to round up!]

James is landscaping his 50 ft. by 40 ft. yard. He will construct a concrete walkway with a uniform width of  $x$  around the centre of the yard which is to be covered in sod, as illustrated below. (Diagram is not drawn to scale.)



Consider the following:

- The walkway must be at least 3.5 feet wide.
- The concrete must be poured 6 inches deep.
- The concrete costs \$3.00 per cubic foot, plus GST and PST.
- The sod costs \$0.40 per square foot, plus GST and PST.
- The budget for this project is \$2150.00.

a) Design a walkway that fits within the budget. Indicate the width of the walkway and the dimensions of the sod below.

Width of the walkway ( $x$ ): \_\_\_\_\_ ft.

Dimensions of the sod: \_\_\_\_\_ ft. by \_\_\_\_\_ ft.

b) Calculate the total cost of your design. (Note: GST 5%, PST 8%)

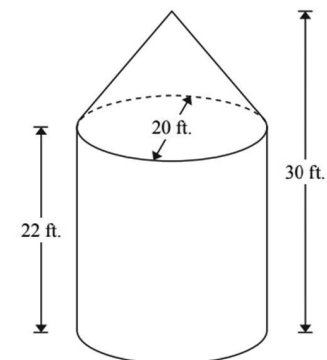
The Menard family has a grain farm.

They own 5 bins for grain storage.

Each bin

- is composed of a cone and a cylinder
- is 30 feet tall (from the top of the cone to the bottom of the cylinder)
- has a diameter of 20 feet
- has a cylinder 22 feet tall

(Diagram is not drawn to scale.)



a) Calculate the volume of one grain bin.

b) Mr. Menard decides to paint the exterior (sides and top) of the bins.

- Each bin needs 2 coats of paint.
- One can of paint covers 400 ft<sup>2</sup>
- Each can of paint costs \$67.99, plus GST and PST.

Calculate the total cost of the paint for the 5 bins.

(Note: GST = 5%, PST = 8%)

Sophie wants to install carpet in her bedroom. The 12 ft. by 9 ft. carpet she wants to install costs \$32.50/yd<sup>2</sup>, plus GST and PST. Calculate the total cost of the carpet.

(Note: GST 5%, PST 8%)

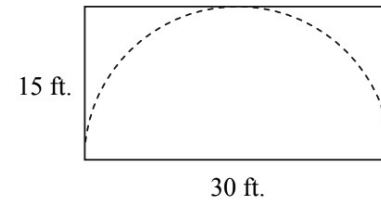
Sheena is wrapping boxes using a roll of wrapping paper with a total area of  $3.5 \text{ m}^2$ . Each box has a 20 cm width, 20 cm length, and 40 cm height. If Sheena uses 20% extra paper on each box, how many boxes can she wrap?

Select the best answer.

The volume of a freezer is  $0.46 \text{ m}^3$ . This volume can also be expressed as:

- A.  $46 \text{ cm}^3$     B.  $460 \text{ cm}^3$     C.  $4600 \text{ cm}^3$     D.  $460\,000 \text{ cm}^3$

A traditional plains tipi is built using a rectangular canvas that is twice as long as it is wide. The diagram below shows how a semicircle would be cut out of a canvas with dimensions of 30 ft. (length) and 15 ft. (width). (Diagram is not drawn to scale.)

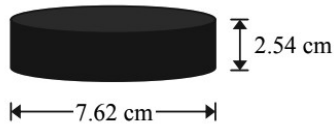


- Calculate how much canvas is left over after the semicircle has been cut out.
- You would like to construct a tipi with both dimensions three times greater than those for the tipi in (a). Given that canvas is only sold in a rectangular shape, how much will the canvas cost if the price of canvas is  $\$7.39/\text{ft}^2$ , plus taxes? (Note: GST 5%, PST 8%)

Eleni is placing cups onto a 7 in. by 10 in. tray. Each cup has a circumference of 10 in.  
Determine the maximum number of cups she can place on the tray.

[For a hockey puck:]

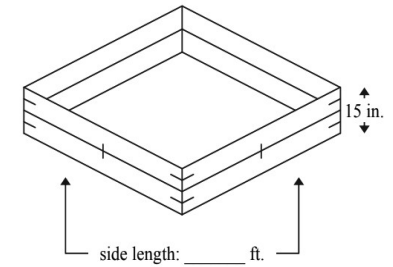
a) What is the volume of a rubber hockey puck?



b) How many pucks can be produced for \$1000.00 if it costs \$0.24 to print a logo on each puck and rubber costs \$0.0036 per  $\text{cm}^3$  ?

You want to build a garden.

- The garden is square.
- The side length is between 8 ft. and 10 ft.
- The garden is enclosed using boards stacked two boards high.
- There are 12 metal supports used to connect the structure.
- The garden is filled with soil to a depth of 15 in.



(Diagram is not drawn to scale.)

Below is the price list for materials:

Item	Cost (plus GST and PST)
metal supports	\$2.00 each
boards	\$2.50/linear foot
soil	\$12.00/ $\text{yd}^3$

Determine the total cost of building your garden. All items must be purchased in whole units.  
(Note: GST 5%, PST 8%)

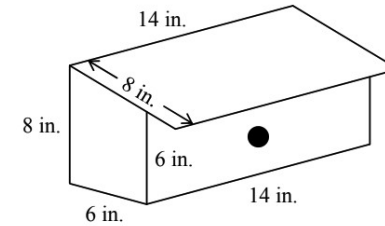


JUN 2017

A spherical balloon has a diameter of 30 cm. Air is added to the balloon until its surface area increases by  $500 \text{ cm}^2$ . What is the new diameter?

Rosalind wants to make a trail mix for a snack. She has 15 ingredients to choose from. What is the total number of different mixes Rosalind can create containing 3, 4, or 5 ingredients?

Students are building birdhouses as a class project. The birdhouses are built to the specifications shown in the diagram below. (Diagram is not drawn to scale.)



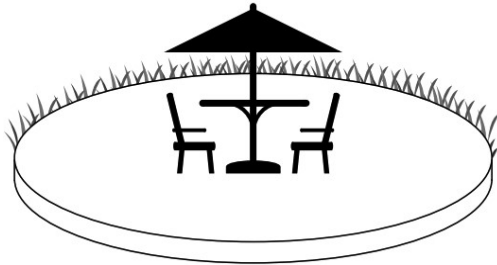
Identify all of the faces of one birdhouse. Use the graphing paper on the next page to illustrate the number of birdhouses the students can build from a 4 ft.  $\times$  3 ft. sheet of plywood.

FACE

DIMENSIONS

JAN 2018

Kami would like to build a circular cement patio with a diameter of 15 feet as shown below.



(Diagram is not drawn to scale.)

- a) Cement costs \$200.00 per cubic yard, taxes included. Kami has a budget of \$600.00 for the patio. Determine how many cubic feet of cement she can buy.
- b) What is the maximum height of the patio, in inches, that keeps her within budget?

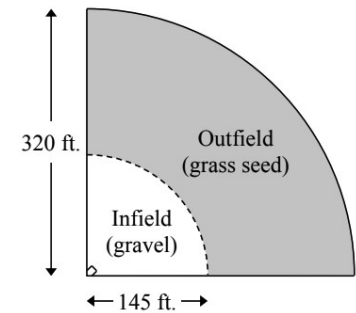
Thierry wants to build a baseball field by his home. He is going to place gravel, to a depth of 4 inches, in the infield and grass seed on top of the existing soil in the outfield.

(Diagram is not drawn to scale.)

The costs are as follows:

- \$1.50 per cubic foot of gravel
- \$16.00 per bag of grass seed, covering 6500 square feet

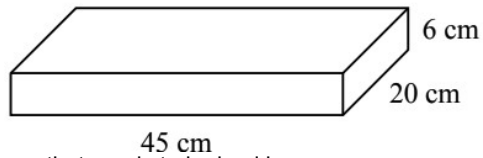
All items must be purchased in whole units and all prices are taxes included.



- a) Determine the total cost to build the baseball field. Assume the field is in the shape of a quarter-circle.
- b) Thierry obtains a loan from the bank to build the field described in (a). If he makes monthly payments of \$400.00, how many months will it take to repay the loan at an interest rate of 6.25%, compounded monthly?

Select the best answer.

Melia baked the following cake and will ice the top and the sides.



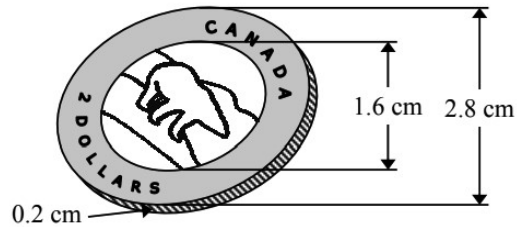
The surface area that needs to be iced is:

- A) 1290 cm<sup>2</sup>
- B) 1680 cm<sup>2</sup>
- C) 2580 cm<sup>2</sup>
- D) 5400 cm<sup>2</sup>

A Canadian two-dollar coin consists of a gold-coloured centre and a silver-coloured outer ring.

The coin has a diameter of 2.8 cm and is 0.2 cm thick while its centre has a diameter of 1.6 cm.

Diagram is not drawn to scale.



Calculate the volume of the silver-coloured outer ring of the coin.

A farmer is selling a cone-shaped pile of grain that has a diameter of 30 feet and a height of 20 feet. The grain needs to be transported to the market by truck.

a) The grain box of the farmer's truck has a volume of 850 cubic feet. What is the minimum number of times the farmer must go to the market to transport all of the grain?

b) Grain is sold by the whole bushel. This grain has a current value of \$8.50/bushel. If one bushel is equal to 1.24 cubic feet, calculate the value of the pile of grain.

JAN 2019

Select the best answer.

Maala needs to shovel a  $1\text{ m} \times 2.8\text{ m}$  walkway after a  $30\text{ cm}$  snowfall. The maximum amount of snow each full shovel can remove is  $0.04\text{ m}^3$  per scoop.

Assuming each scoop contains the maximum amount of snow, how many scoops will it take for her to remove all the snow from the walkway?

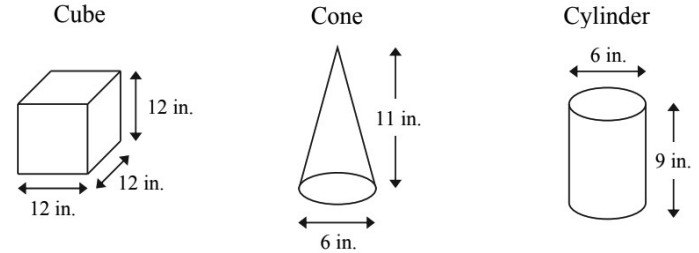
- A) 21      B) 70      C) 336      D) 2100

Hugo creates a scale model of a planet for art class. He wants to paint it.

- The radius of the model is  $20\text{ cm}$ .
- He has one bottle of paint that will cover  $12\,000\text{ cm}^2$ .
- It is assumed that each coat applied requires the same amount of paint.

How many full coats of paint can be applied using the one bottle?

You are entered in a sandcastle building contest. Pails in the following shapes are available for use:



Shapes are not drawn to scale.

Your sandcastle design must:

- be built on a  $2\text{ ft.} \times 1\text{ ft.}$  area
- use each shape at least once
- include a minimum of 5 shapes
- be no more than 3 shapes high

a) Draw or describe a sandcastle that meets the above criteria.

b) Calculate the volume of sand required, in cubic feet, to build your sandcastle.