Math Academic Prep Tasks

Name/email address:

TASK 1: Money Math
(Show you calculations)

1. A basket of blueberries cost $4.70. Mary bought 4 baskets of blueberries and paid with a $20 bill.

What change should Mary receive?

a) $17.19
b) $14.30
c) $1.20
d) $2.90
e) $1.85

2. A picture originally costs $50. If it goes on sale for 20% off, what will the sale price be?

a) $40.00
b) $20.00
c) $32.00
d) $38.00

3. Mark wants to buy a pair of jeans costing $70. Sales tax on his purchase is 13%.

What will be the total cost of the jeans?

a) $9.10
b) $55.20
c) $79.10
d) $67.80

4. Tim is having a yard sale. A customer purchases a chair for $13.35 and gives him a $20.00 bill.

a) Determine how much change is owed to the customer.

b) Explain in detail 3 different ways that Tim could make the correct change:

5. Kelly sees an advertisement for a Notebook with Windows 8.1 OS.

15.6'' Touch screen notebook
Original price: $800
Sale: 30%

How much will the Notebook cost after the discount and including sales 13 % tax?

6. Tommy needs to Purchase motor oil. He compares the following two prices Midas is selling a 4.4 litre jug of oil for $35.39 Canadian Tire is selling a case of 6litres of the same oil for $46.00.

Which store is offering oil at tile lowest price per litre?

7. Sally wants to buy fabric to make a blanket. She plans to buy 9 metres of fabric. Two stores are offering the same fabric on sale. Fabric Land is selling the material originally priced at $31.00 per metre with a 50% discount. Michaels is selling the same fabric at $39.00 per metre, but is giving away 2 free metres of the material for every 1 metre purchased.

Which store is a better deal?
Show your calculations and explain how you know which one is the better deal.

TASK 2: Data Management and Proportions
(Show you calculations)

1. Potatoes costs $5.00 for a 3-kg bag.

What is the cost if you need to purchase 12-kg of potatoes?

a) $6
b) $18
c) $25
d) $20
e) $36

2. Carlie's car uses 30 litres of gas to travel approximately 200 kilometers.
If she drives about 1000 kilometers, about how much fuel should Carlie expect to use?

a) 50 Litres
b) 80 Litres
c) 100 Litres
d) 250 Litres
e) 150 Litres

3. Sammy was paid $300 for working a 6-hour day.
At this rate, about how many hours would he have to work to earn approximately $1000?

a) 7 hours
b) 20 hours
c) 30 hours
d) 25 hours
e) 40 hours

4. Candice is studying to become a pharmacy assistant. She has learned that she is going to need to use her math skills to calculate quantities of medication to determine the appropriate amounts.

The customer's prescription reads: 3 (10 mg) capsules, twice daily for 9 days
a) How many 10 mg capsules will Candice need to complete the prescription?

The customer's prescription reads: 2 (20mg) capsule daily, 14 day supply. The store only has 10mg capsules available to fill the prescription.

b) How many 1Omg capsules will Candice need to complete the prescription?

5. A customer's prescription calls for a total of 40 grams of medical cream consisting of 5% hydrocortisone powder and 95% cream.
   How many grams of powder and how many grams of medicated cream will Candice need to prepare the prescription?

6. A customer's prescription reads: 250 mg of active antibiotic, 3 times/day for 10 days. A liquid solution is available containing 25 mg of the active antibiotic for every 1 ml of liquid.

a) Knowing that each dose is 250 mg, how much liquid will Candice need to prepare for each dose?

b) How much liquid will Candice need to complete the entire 10-day prescription?

7. Candice's friend Adam is studying to become a nurse aide. Some of his tasks will require him to rely on his math skills. Adam will be responsible for assisting his patients with bathing.

   Adam allots 35 minutes for bathing each patient, and an additional 10 minutes between patients to prepare for the next patient.

   Based on Adam's current patient lists shown in the chart below, what is the minimum time Adam will require today to bathe all of his patients?

Patient	Room	Time
John Smith	A9	
Susanna Morris	A11	
Julie Lee	A12	
Katie Ball	A17	
Jennifer Adams	A21	

8. Health care aides use a 24-hour clock.
   Using your answer from question 7, if Adam begins his bathing rounds at 16:30, what time should he expect to finish his rounds? Express times in 24 hour clock and 12 hour clock.
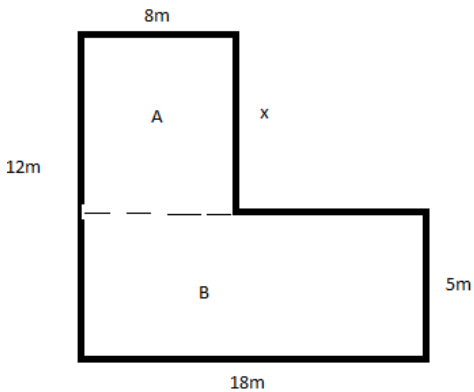
Task 3: Geometry

A) Finding the area of a two shaped figure, like an L shaped room.
Step I: Divide the shape into two rectangles.
Step II: Find the unknown side of the one rectangle.
Step III: Find the area of each rectangle.
Step IV: Add the areas of the two rectangles together.

Step I: represented by the dotted line.

Step II: To find x subtract 5m from 12m

$$X= 12m-5m$$
$$X= 7m$$

Step III: To find the area of each rectangle, label one rectangle A and the other rectangle:
Area A: length x width
=L x W
=7m x 8m
$= 56m^2$
Area B: L x W
= 18m x 5m
$= 90m^2$

Step IV: Add the area of rectangle A and B= $56m^2$ + $90m^2$
$$= 146m^2$$

Answer: The area of the room is $146m^2$.

Exercise:

1. The diagram below shows the dimensions for an L-shaped room. All angles are right angles.

5 m

x

10 m

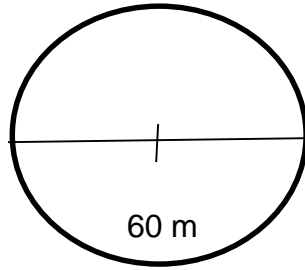3m

14 m
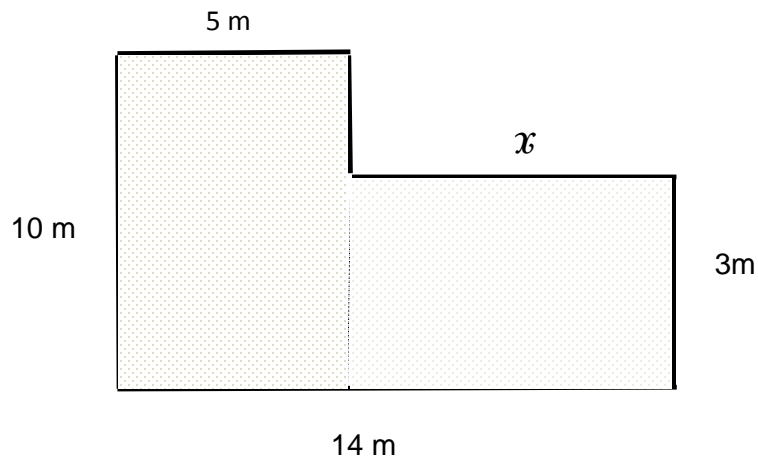
a) The length of tile side x is:

   a) 3m
   b) 4m
   c) 5m
   d) 6m
   e) 9m

b) What is the area of the shaded region?

   a) 77m²
   b) 44m²
   c) 82m²
   d) 98m²
   e) 117m²

B) <u>Finding the area of a Circle</u>

The formula for the area of a circle is: $A = \pi r^2$, where r is the radius of the circle. Use the value of $\pi = 3.14$.

60 m

In this diagram, 60m is the diameter of the circle. To find the radius of the circle shown divide the diameter in half. Therefore, the radius is always half of the diameter.

r= 60m ÷ 2 = 30m

In the formula, r^2 represents a square number. A square number is a number you get when you multiply an integer by itself.

Since, r is the radius, that means $r^2 = r \times r$ and then using the example, $r^2 = 30 \times 30$

$A = \pi r^2$
  = 3.14 x 30m x 30m
  = 2826m^2

Answer: The area of the circle is 2826m^2.

<u>Exercise:</u>

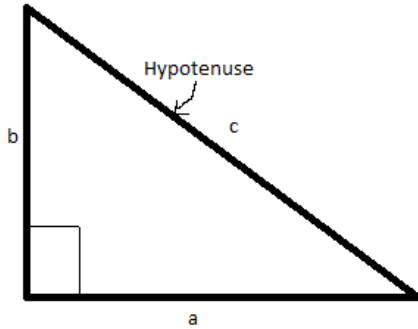- A circle has a diameter of 70 cms.

  Find the area of the circle.

  The formula for the area of a circle is $= \pi r^2$

70 cms
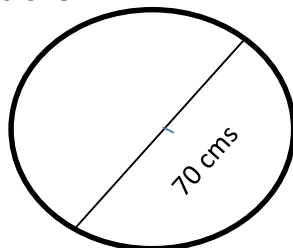
a) 1225 cm^2
b) 3846.5 cm^2
c) 2512 cm^2
d) 2096 cm^2
e) 15386 cm^2

C) Pythagorean Theorem

The Pythagorean Theorem applies to a triangle where two sides meet at a right angle (90⁰). The side opposite the right angle is called the hypotenuse.


The Pythagorean Theorem was discovered by a Greek mathematician Pythagoras who found that the square of the length of the hypotenuse of a right triangle is equal to the sum of the squares of the lengths of the other two sides. Using the labels in the triangle above:

Pythagorean Theorem: $c^2 = a^2 + b^2$ in words hypotenuse squared equals side squared plus side squared.

Example of Pythagorean Theorem:
Find the length of the hypotenuse in the triangle below:
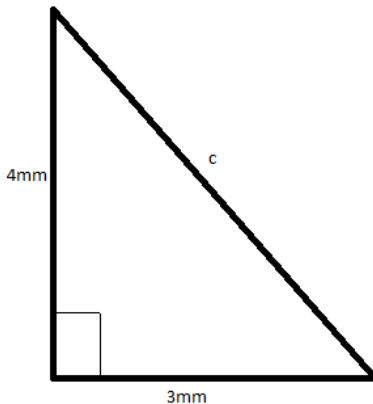
Pythagorean Theorem: $c^2 = a^2 + b^2$

Step I: Substitute 3 for **a** and 4 for **b** in the Pythagorean Theorem.

$c^2 = a^2 + b^2$ ($3^2 = 3\times3$)
$c^2 = 3^2 + 4^2$ ($4^2 = 4\times4$)
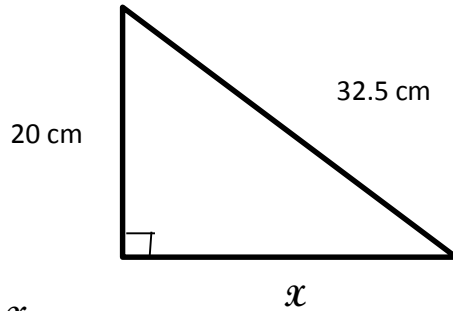$c^2 = 9 + 16$
$c^2 = 25$
$c = \sqrt{25}$
$c = 5$
Answer: The length of the hypotenuse is 5mm.

Exercise:

- Use the Pythagorean Theorem to find the length of side x.

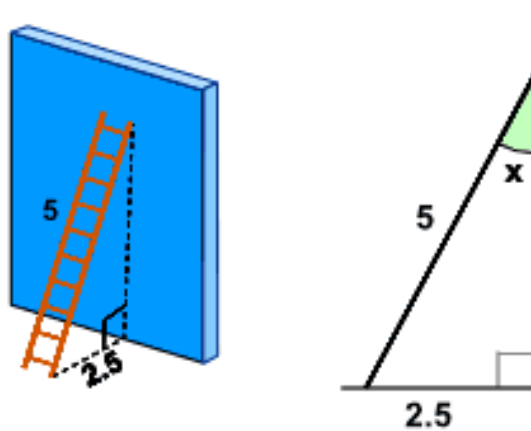The formula is $a^2+b^2=c^2$, where c is the length of the hypotenuse.

What is the value of x:

a) 17.3cm
b) 28.3cm
c) 25.6cm
d) 31.4cm
e) 39cm

D) Trigonometry

Finding an unknown angle in a right-angled triangle, you use the known length of two of its sides.
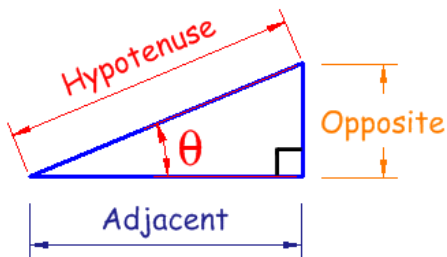
Example:

A 5-foot ladder leans against a wall. What is the angle between the ladder and the wall?
The answer is to use Sine, Cosine or Tangent. Which one to use?

Step I: Find the names of the two sides you know.

Adjacent is adjacent (beside) the angle. Opposite is opposite the angle.
Hypotenuse is the longest side, opposite the right angle.

In the example, we know the length of the side opposite angle x (2.5ft) and the longest side opposite the right angle, called the hypotenuse (5ft).

Step II: To find out which one of Sine, Cosine or Tangent to use:

SOH Sine: $\sin \theta = \dfrac{\text{opposite}}{\text{hypotenuse}}$

CAH Cosine: $\cos \theta = \dfrac{\text{adjacent}}{\text{hypotenuse}}$

TOA Tangent: $\tan \theta = \dfrac{\text{opposite}}{\text{adjacent}}$

A way to remember is "SOHCAHTOA"

<u>Step III:</u> Put the values into the Sine equation, since we know the length of the opposite side to angle x and the length of the hypotenuse.

$$Sin(x) = \dfrac{\text{opposite}}{\text{hypotenuse}} = \dfrac{2.5}{5} = 0.5$$

<u>Step IV:</u> Solve the equation.

Sin (x) = 0.5

This can be rearranged $x = \sin^{-1}(0.5)$

With a scientific calculator: (please note that different scientific calculators operates differently:

a) key in 0.5 and use the $\sin^{-1}$ button to get the answer. $x = 30^0$.

b) Make sure the mode: Deg, then 2nd Fn, $Sin^{-1,}$ then 0.5 = 30^0.

Note: To use $\sin^{-1}$ you would press either '$2^{nd}F$ sin' or 'shift sin.' It is the same to use $\cos^{-1}$ or $\tan^{-} 1$.

What is $\sin^{-1}$?

Well, the Sine function "sin" takes an angle and gives us the ratio "opposite/hypotenuse."
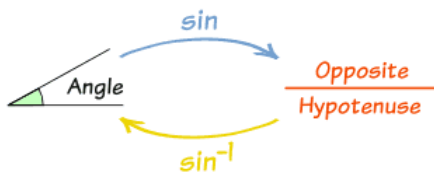
But $\sin^{-1}$ (called "inverse sine") goes the other way....it takes the ratio "Opposite/Hypotenuse" and gives us an angle.

Example: Sine Function: $\sin(30^0) = 0.5$
Inverse Sine Function: $\sin^{-1}(0.5) = 30^0$

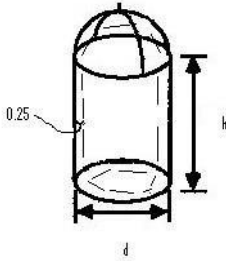**Answer:** x= 30^0 The angle between the ladder and the wall is 30^0.

E) Volume of a Silo

To calculate the volume of a silo, it will have to be broken into two parts: the volume of a cylinder and the volume of a hemisphere (which is half the volume of a sphere).
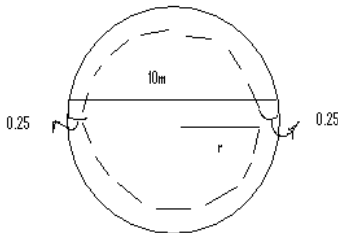
i.   Volume of a Cylinder:

We know the height of the silo is 20m, the diameter is 10m, and the walls are 0.25m thick.

Volume of a cylinder: $\pi r^2 h$

π = 3.14, h=20m

The radius needs to be calculated. The diameter is 10m but then the wall thickness of 0.25m needs to be taken away from the diameter before the radius can be calculated.

r = $\dfrac{10m - 0.25m - 0.25m}{2}$

r = $\dfrac{9.5}{2}$

r = 4.75m

Volume of the cylinder = $\pi r^2 h$

= 3.14 x 4.75m^2 x 20m

= 1416.9m^3

ii.   Volume of a Sphere

Volume of a sphere = $\dfrac{4}{3} \pi r^3$

= $\dfrac{4}{3}$ x 3.14 x 4.75^3

= 448.8m^3

Remember for the silo the volume of only half a sphere is needed.

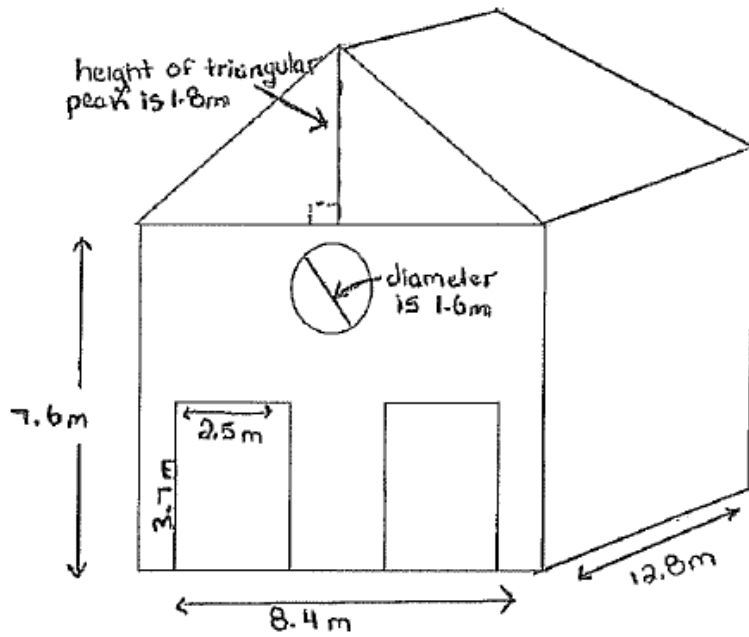So: $448.8m^3 \div 2 = 224.4m^3$ is the volume of the half sphere or hemisphere.

To calculate the maximum volume of the silo: add together the volume of the cylinder and the volume of the hemisphere.

$1416.9m^3 + 224.4m^3 = 1641.3m^3$

Answer: The maximum volume of the silo with walls 0.25m thick is $1641.3m^3$.

Exercise:

Part A: Andy bought a farm. The barn houses farm vehicles and equipment.

He has to do some renovations on the farm.

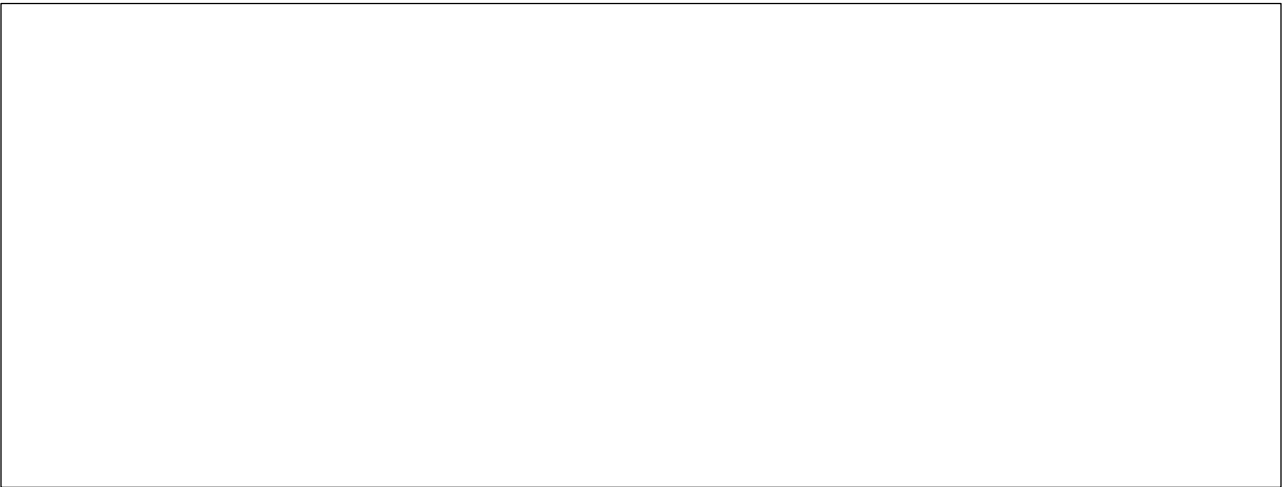The front of the barn has two congruent door entrances and a circular window.

1. The front, back and two sides of the barn will be covered in aluminum siding (except for the window and two doors).
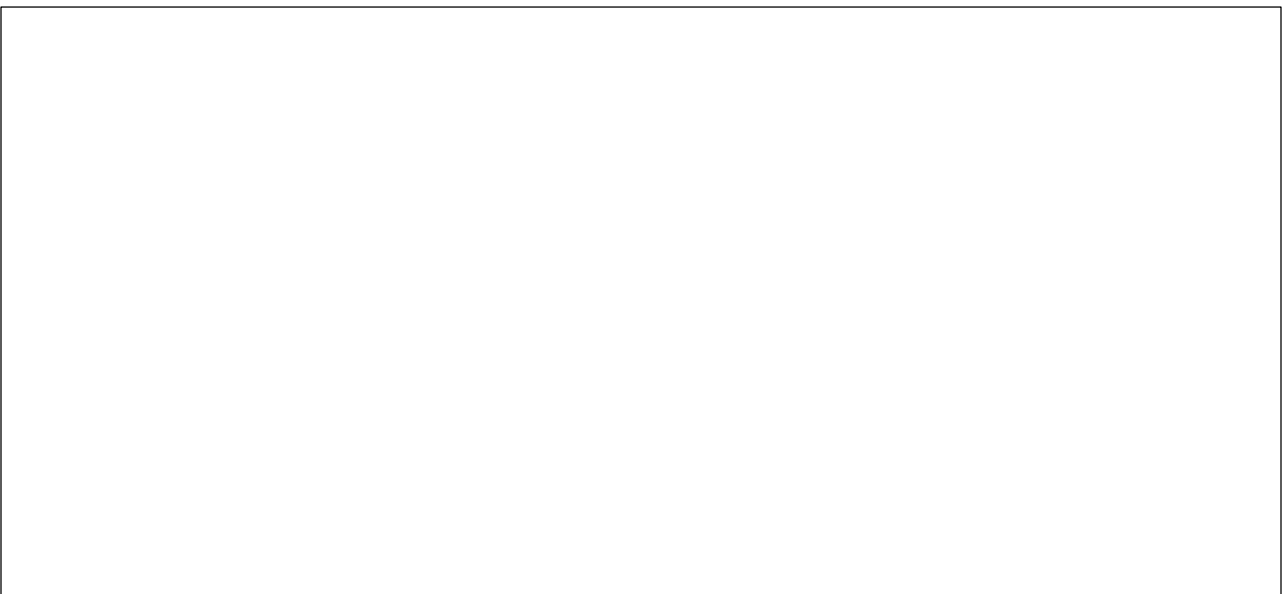
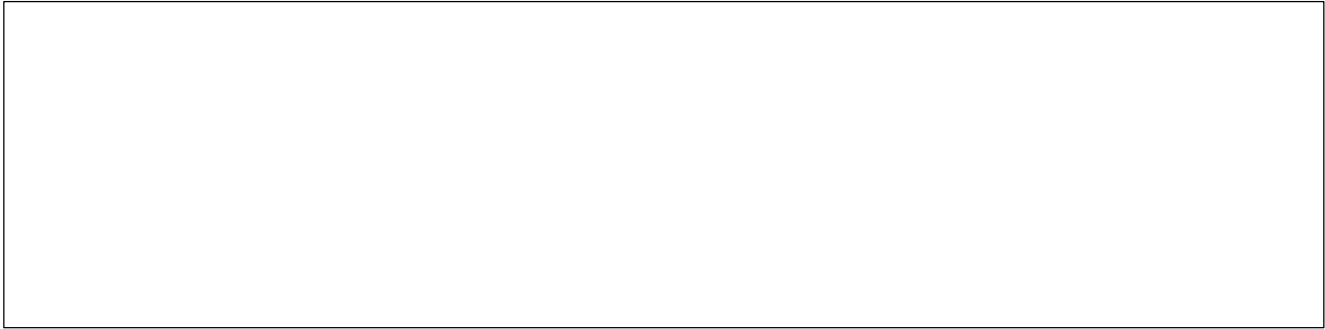The area of the two front doors:

Area of circular window:

Area of triangular peak al front and back:

Area of the sides of the barn:

Area of front and back:

[ ]

Use your answers from the previous pages and above to find the total area of siding and explain your thinking.

2. The aluminum siding is purchased in square feet and costs $3.50/square feet. What will be the cost for Andy to cover the walls of the barn? To determine Andy's costs you must convert from metres to feet. The conversion chart may be useful.

Conversions: Metric and Imperial Units of length

Imperial to Metric	Metric to Imperial
1 inch = 2.54 cm	1 cm = 0.3937 inches
1 foot (ft) = 30.48 cm	1 m = 30.37 inches
1 foot(ft) = 0.3048 m	1 m = 3.2808 ft
1ft^2 = 0.0929 m^2	1 m^2 = 10.76 ft^2

3. a) The roof of the barn is composed of 2 rectangles and will be covered in steel sheets. A diagram of the roof of the barn has been re-drawn below.
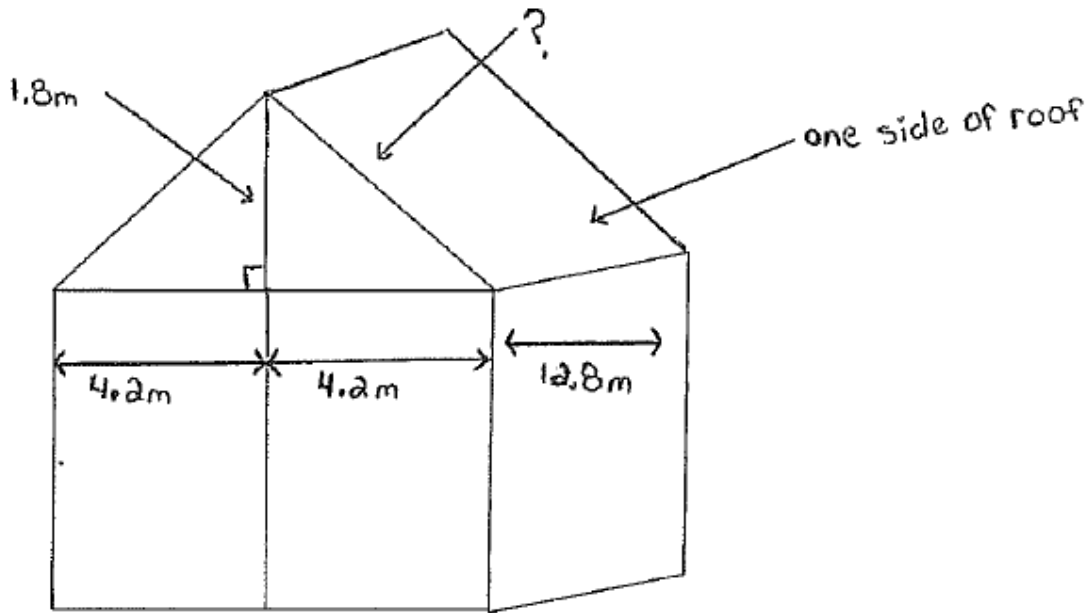
Determine the area of the steel sheets that will be needed to cover the entire roof, to the nearest square metre.

To find the area of the roof, you must first find the length of the side marked with a "?" on the diagram.

The Pythagorean Theorem could be useful for this task.

$$\text{The formula is } a^2 + b^2 = c^2$$

3 b)The roof of the barn needs to be inspected to ensure it is up to code. The pitch of the roof has to have a minimum pitch of 15°.
Calculate the angle shown in the diagram and explain how you know the barn roof meets the requirements.
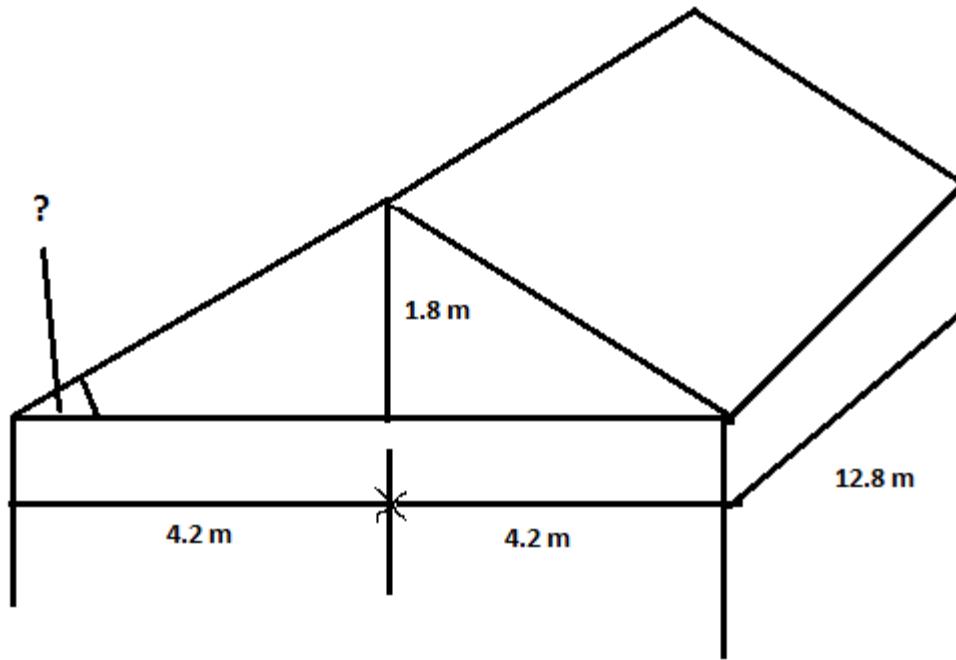
?

1.8 m

4.2 m   4.2 m

12.8 m

5. Jacob is going to use the silo beside the barn to store grain for some neighbouring farmers to help pay off the costs of redoing his barn. The dimensions of the silo are shown:
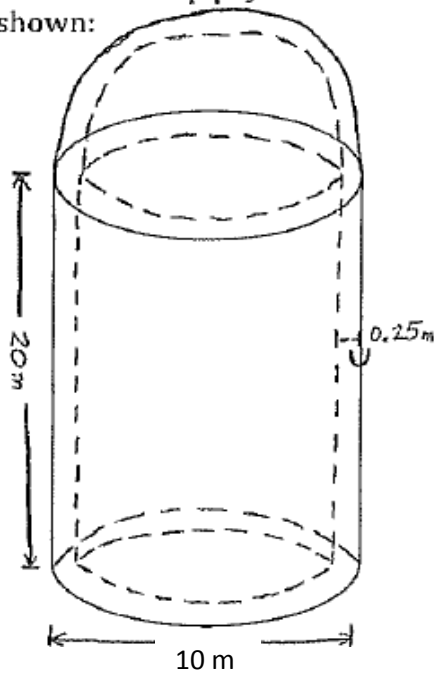
1. The inside diameter of the cylinder and spheres is needed to calculate the volume. You must determine the diameter of the inside of the silo, if the walls are 0.25m thick.

2. This silo is composed of a cylinder and half of a sphere.

4. The steel sheet roofing costs $3.50/ square foot

What will be the cost for Andrew to cover the roof of the barn with steel sheets?

1. The inside diameter of the cylinder and spheres is needed to calculate the volume. You must determine the diameter of the inside of the silo, if the walls are 0.25m thick

   This silo is composed of a cylinder and half of a sphere.
2. Calculate the maximum volume of the silo, if the walls are 0.25m thick?

Show your formulas and your work

5. How many <u>bushels</u> of grain can be stored in Andrew's silo? Show your work.

The information in the box may be useful in making the conversions.

A bushel is an old unit used to measure the volume of produce.   **<u>Conversions</u>**   1 bushel = 1.2843 ft^3

6. If Andrew charges $0.14/ bushel for every three months for grain to be stored in the silo, how much will he make if the silo is filled to capacity for nine months.

Task 4: Earning A Living

<u>Linear Relations Skills</u>

1. Tammy owns an air duct cleaning company· and charges customers using the formula

$$C=3v+200$$

Where C is the cost in dollars and v is the number of air vents in the house.

a. What is the total cost to clean a house with 24 vents?

   a) $78
   b) $272
   c) $228
   d) $528
   e) $176

b. If tile cost to a customer is $308, how many vents must be in tile customer's home?

   a) 34
   b) 45
   c) 36
   d) 41
   e) 31

2. Examine the advertisement below.

Classy
$40 per day

Your first 300 Km are Free!
$0.60 for each additional km

Mary rents a car for 1 day and drives 850 kilometres.
An expression she could use to calculate tile cost is:

   a) cost= 4-50 x 0.60 + 40
   b) cost= 550 x 0.60 + 40
   c) cost= 550 x 0.60 + 38

3. Henry installs hardwood floors. He charges an initial cost of$175, plus an additional charge of $3.50 per square foot of flooring.
If **c** is tile total cost of installation in dollars, and **f** is the number of square feet of flooring. Tile equation that represents this situation is

   a) C = 175 + 3.50f

b) C = 3.50 (f + 175)
c) C = 175 (f + 3.50)

4. The graph below shows the altitude (in metres) of a plane over a 20 minute time interval
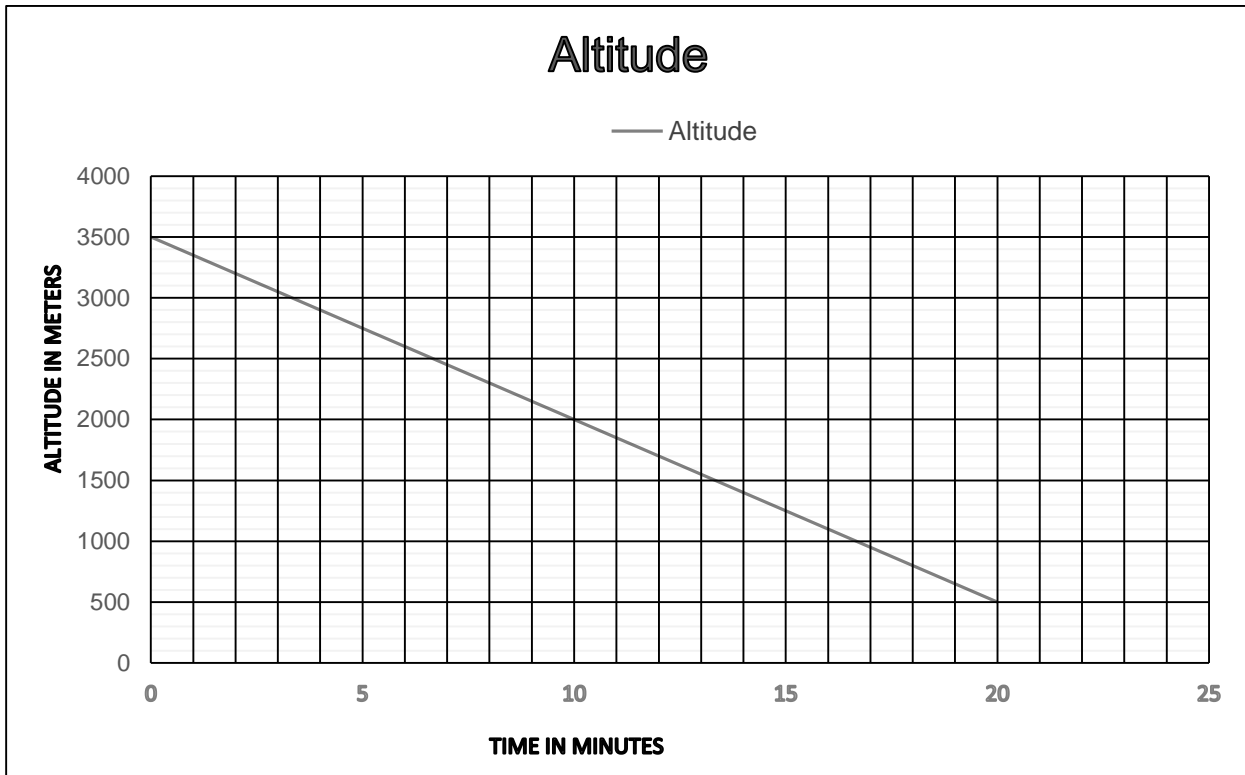
At what time is the plane at an altitude of 3200 m?

a) 4 minutes
b) 6 minutes
c) 8 minutes
d) 10 minutes
e) 2 minutes

At which rate is the plane decreasing, in meters per minute?

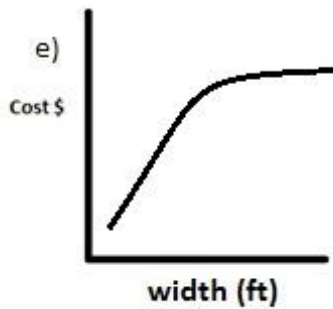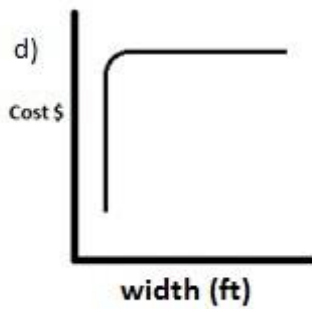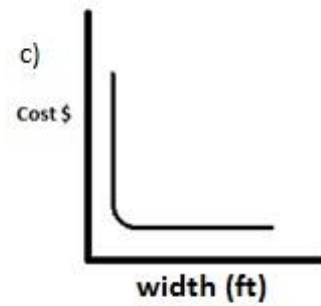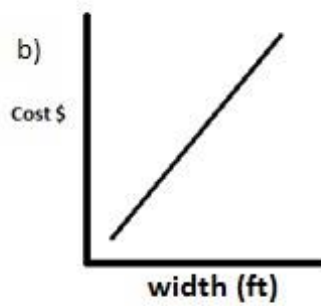a) 50 m/min
b) 125 m/min
c) 150 m/min
d) 500 m/min
e) 1250 m/m

Task5-Landscaping

1. A company manufactures square patio stones and the cost for individual stones varies with the width of the square tile as shown in this chart.

Width (feet)	Cost per Stone($)
1	$2
2	$4
3	$6
4	$9
5	$9

If this relationship were plotted on a graph, which of the following sketches best represents the graph?

a)

Cost $

width (ft)

b)

Cost $

width (ft)

c)

Cost $

width (ft)

d)

Cost $

width (ft)

e)

Cost $

width (ft)
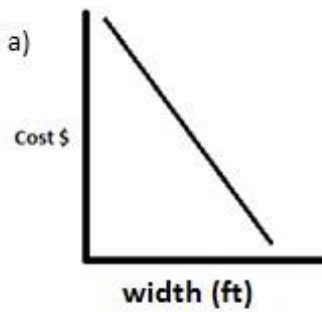
2. What is the value of m that solves this equation?
7(m-1)=6(m+1)

   a) 13
   b) 5
   c) 7
   d) 11
   e) 21

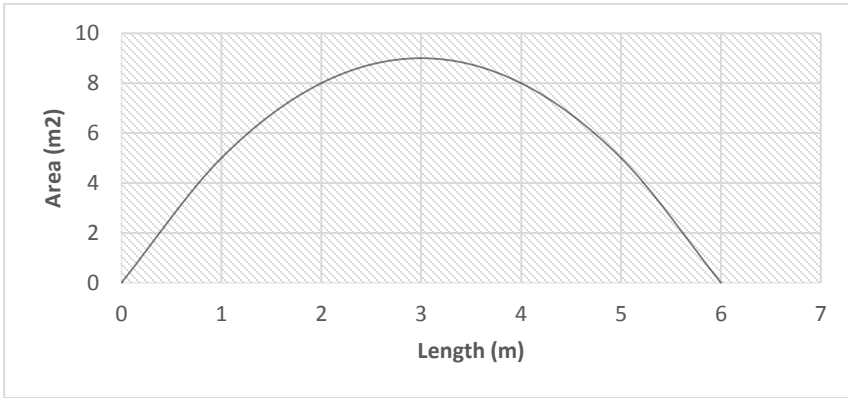2. The graph shows the relationship between the length and area of a rectangle.

What is the length of the rectangle with the largest area where its perimeter is 12 m?

   a) 2m
   b) 3m
   c) 6m
   d) 9m
   e) 10m

3. Examine the following expression: $x(3x + 5) + 4(2x - 6)$
What is the equivalent expression?

   a) $3x^2 + 13x - 24$
   b) $3x^2 + 9x - 24$
   c) $3x^2 + 13d)x - 6$
   d) $x^3 + 9x + 24$
   e) $16x - 21$

6. Tania has 10 apple trees on her farm and each tree produces 250 apples. She knows that each additional tree she plants, the output per tree is reduced by 20. She uses the following formula to determine the number [n] of additional trees to plant to maximize apple production (P)

$$P = (10 + n)(250 - 20n)$$

The equivalent expression is:

   a) $P = 2000 - 15n^2$
   b) $P = 2000 + 35n^2$
   c) $P = 2000 + 50n - 1Sn^2$
   d) $P = 2500 + 50n - 20n^2$ $P = 210 - 1411n$

Task 6: Linear Relations

A variable in an equation is an unknown number.

Example: $4n + 2 = 15$

"**n"** represents an unknown number.

In some cases, the value of the variable is known. If so, substitute the number for the variables in the equation and evaluate the expression.

Example: $y = 5b + 3$, where $b = 5$
$y = 5(5) + 3$
$y = 25 + 3$
$y = 28$

Simplifying Equations:

Use inverse operations.

Operations are adding, subtracting, multiplying and dividing.

An inverse operation is an operation that reverses the effect of another operation.
Addition and subtraction are inverses of each other.
Multiplication and division are inverses of each other.

Examples:
With numbers: $18 + 4 = 22$
$18 + 4 - 4 = 22 - 4$
$18 = 18$
With variables and numbers:
$x + 4 = 22$
$x + 4 - 4 = 22 - 4$
$x = 18$

$m \cdot 2 = 10$ » means multiply
$m \cdot 2 = 10$ » Divide both sides by 2, to isolate m and find the value of m.
$m = 5$

Writing Algebraic Equations:

Step 1: To identify what information the variable is going to represent.

Step 2: Determine the operation(s) (adding, subtracting, multiplying or dividing) needed to make the equation true.

Example:

1. Sam rents a U-Haul for a day. The first 350 kilometers are free and it is 0.55 cents for each additional kilometer. Sam knows he will be driving over 350 kilometers. The rental of the U-Haul is $38.00 per day. What would be the equation to calculate the cost of the U-Haul?

The variable "k" will represent the additional kilometers Sam drove.

Remember the first 350km are free. So, since the additional kilometers are not known it would be represented as k-350 which will equal the amount of kilometers Sam has to pay for.

To find out the cost of the additional kilometers: Take the total kilometers (represented by "k") and subtract 350. Take that answer and multiply it by 0.55cents.
The equation would be (k-350)* 0.55.

Finally, the addition of the rental of the U-Haul needs to be added. Therefore, the

equation to calculate the cost of the U-Haul would be:
38 + (k – 350) *0.55

2. "The amount of money Alice makes depends on the number of days she works."

Suppose you know that Alice makes $100 per day. Then we could make a chart like

this:

0	1	1½	8
0	100	150	800

If Alice works this many days... ...she makes this many dollars
If you tell me how long she has worked, I will tell you how much money she has made. Her earnings "depend on" how long she works.

So if we were to graph Alice's earnings for a month. The independent variable number of days worked are placed on the horizontal axis. While the values of the dependent variable- earnings- are placed on the vertical axis

3. The graph shows the cost of a phone call depending on the length of the phone call in minutes. The x-axis is the length in minutes and the y-axis is the cost $.
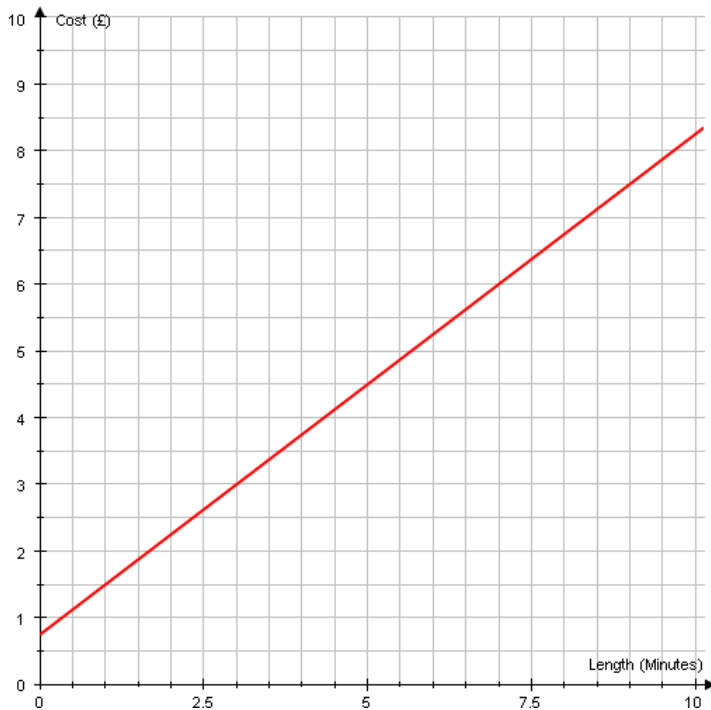
Using the graph, work out:

a. The cost of a 5 minute phone call.

b. How long can you talk for $5?

c. Why does the graph not start at the origin?

d. Write down a formula connecting the cost (C) of a phone call and the length of the phone call in minutes (m).

4. Ted and Jason are going to race their dirt bikes. Since Ted is younger, Jason is going to give him a 10 mile head start. Ted travels at 10 mph and Jason travels at 20 mph. Write linear equations to represent each boy during the race. Prepare a graph representing the race. Put the time in hours on the x-axis and the distance in miles on the y-axis.

At what time will Jason catch up with Ted? How far will they have traveled when they meet?

With a head start of 10 miles, Ted's line starts at 10 when time is zero, or the point (0, 10). For every hour that passes, Ted's distance increases by 10 miles. This rate of change is the slope of his line (m = 10).
Ted's equation: $y = 10x + 10$

Jason's line starts at zero since he did not get a head start, or at the point (0, 0). For every hour that passes, Jason's distance increases by 20 miles. This rate of change is the slope of his line (m = 20).
Jason's equation: $y = 20x + 0$

Jason will catch up with Ted when the two lines intersect or after one hour. They will have traveled 20 miles when they meet.

Draw the graph to represent Ted and Jason's dirt bike race. Ask your instructor for paper. When complete hand in to your instructor.

Alex is setting up a lawn care business. For each customer he plans to charge a one-time fee of $25 and additional $10 per hour.

The graph below shows his rates.
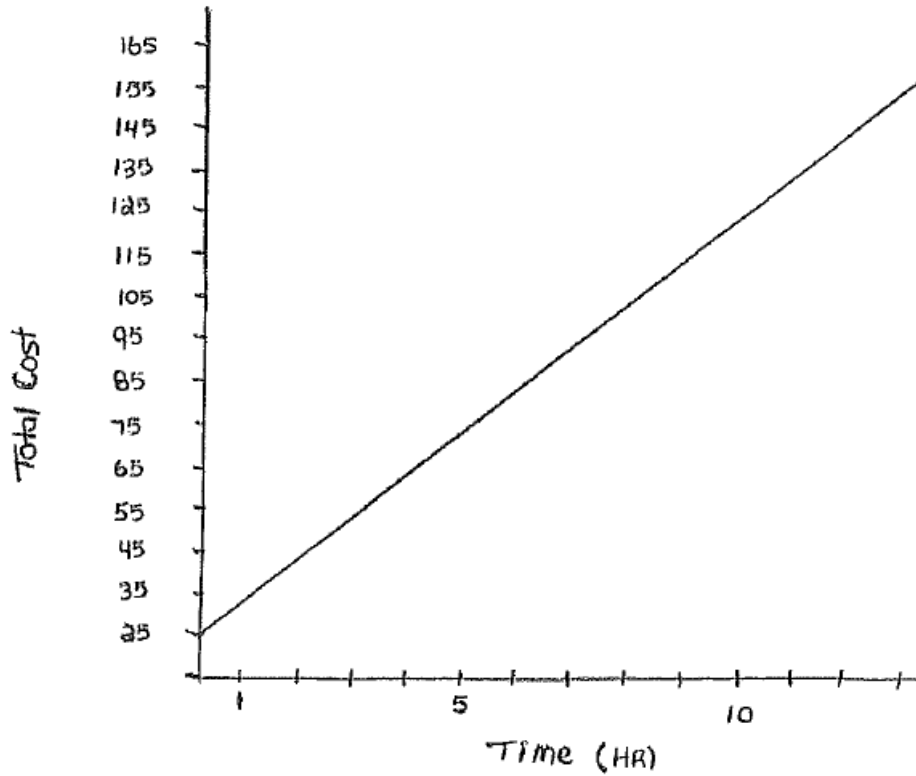
1. How much in total did Alex work?

2. A customer receives an invoice for $215.00. How many hours did Alex work to earn this money?

3. Create an equation that would represent this line. Use C for cost (in dollars) and h for the number of hours worked. Show your work and explain your thinking.

2. Mindy runs a similar business, with an initial fee and an hourly rate.
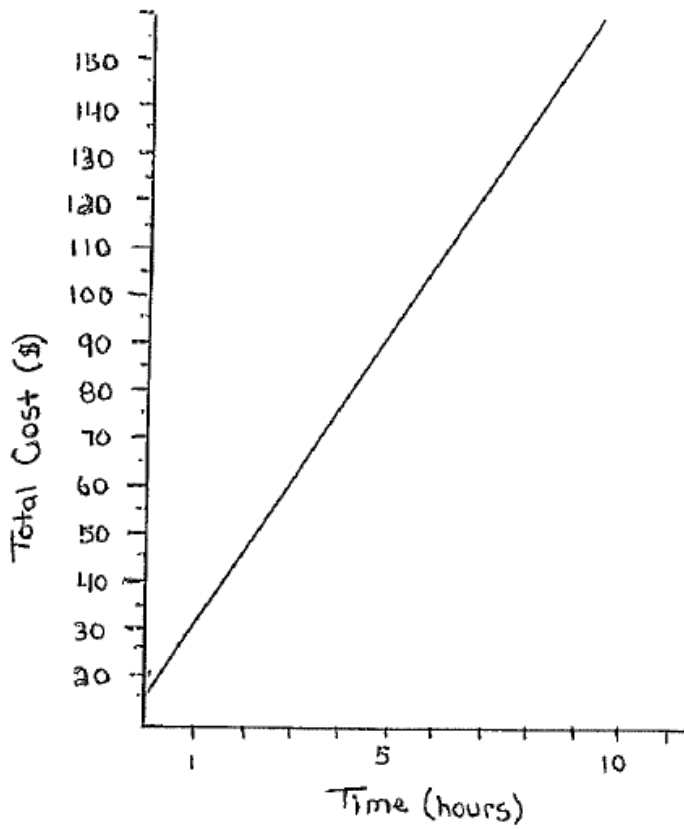
1. How much does Mindy charge as an initial fee? Explain how you know.

2. How much does Mindy charge for each hour of work? Explain how you know

Another similar business, Bob's Grass Care, charges an initial fee of$30.00 and an hourly rate of $10.00. If you did not print this document, then ask you instructor for some graph paper and draw the line that represents Bob's charge on Mindy's graph.

Pay cheques are calculated several ways. An employee can earn a salary, a commission, an hourly rate, or some combination of these methods. It is important to be able to read and evaluate the information included on a pay cheque. The owner of a small business must be able to prepare pay cheques using rates of pay, deduction schedules, calculations of bonuses and other factors.

3. Amanda has been offered three jobs as a computer salesperson. All job offers are based on a 40-hour work week.

- Office Depot will pay her $300 per week plus a 8% commission on all sales

- Future Shop will pay her $18.00 per hour for a 40 hour week

- Apple will pay her $600 per week plus a 4% commission on all

Commission: A portion of total sales made by an employee that is paid to the employee

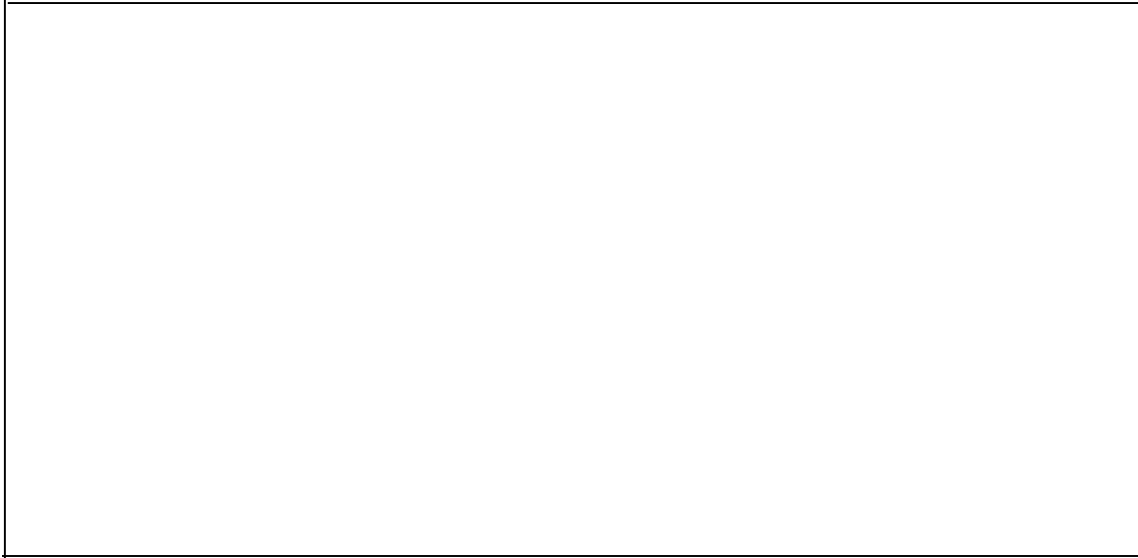Use the graph to help you answer the following questions.
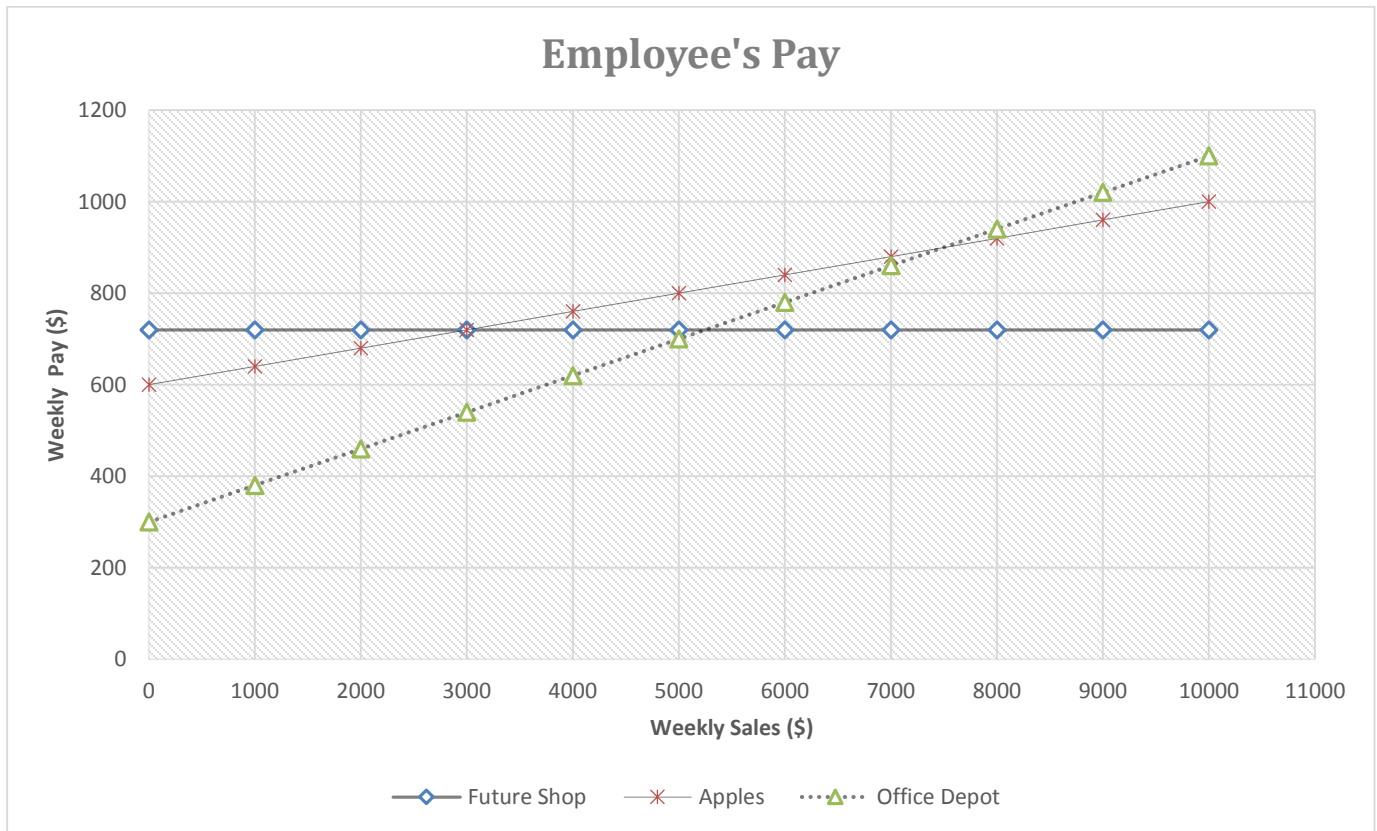
2. If Amanda makes weekly sales of $3000, which job would pay her the most money for two week?

Explain how you know.

3. Which company would pay her the most money if she expects to make weekly sales of $5000?

Explain how yon know.

4. What information does the point (8200, 945) provide to Amanda? Explain what each number represents and the importance of the point itself.

Amanda decides not to accept the job at Office Depot because it is too far away from her home.

Estimate from the graph what her total weekly sales must be at Apple so that she could be earning more than at Future Shop.