



**568-526**

Mathematics

**Comprehensive Exam  
Number 53**

GUIDE

Secondary 5

September, 2003



**Youth Sector General Education**



## 1. GENERAL INFORMATION

- 1.1 Program Mathematics, Secondary 5 (568-526)
- 1.2 Origin Mathematics Coordinating Committee Examination, 2003  
Computerization by Martine Sanscartier, BIM, Société GRICS
- 1.3 Time allotted 3 hours
- Administration This examination is to be given on June 18, A.M.
- 1.4 Number of questions 25 questions distributed as follows  
10 multiple-choice questions  
6 short-answer questions  
9 developed-response questions
- 1.5 Authorized material
- Ruler, compass, set square, protractor
  - Graph paper
  - Scientific calculator with or without a graphic display

The calculator must be portable and designed primarily to perform mathematical calculations. Computers and calculators with a QWERTY keyboard, symbol manipulation capabilities or an electronic date book are not permitted. User guides, memory expansion features or any other calculator accessories are not permitted during the examination. Students may not share their calculators with other students. Communication links between calculators are also forbidden during the examination.

- Memory aid

The memory aid is **one** letter-size sheet of paper ( $8\frac{1}{2} \times 11$ " ) on which a student will have recorded information of his or her choice. Students are encouraged to work on and revise their memory aid throughout the year. Both sides of the sheet may be used. Any mechanical reproduction of this memory aid is forbidden. Students may not share their memory aids with any other students.



## 2. DESCRIPTION OF THE EXAM

The chart below shows the distribution of the items taking into account the relative importance given to the different components of the program.

### Exam Specifications

Themes	Algebra 68%	Geometry 20%	Statistics 12%
Skills			
Mastery of Concepts 28%	1, 2, 3, 4, 11	6	9
Mastery of Application 36%	5, 12, 13, 14, 15, 16	7, 8	10
Mastery of Problem Solving Techniques 36%	17, 18, 19, 20, 21, 24	22, 23	15

**Note** The numbers in the centre of each box represent the question numbers in the examination.

**Item Specifications**

Question	Item	Objective	S	T	D	
Part A						
	1	2001	ALG.01.01	C	M	E
	2	2002	ALG.02.01	C	M	M
	3	2003	ALG.04.01	C	M	E
	4	2004	ALG.04	C	M	E
	5	2005	ALG.02.04	A	M	E
	6	2006	GEO.01.01	C	M	E
	7	2007	GEO.01	A	M	M
	8	2008	GEO.01.02	A	M	M
	9	2009	STA.01.06	C	M	E
	10	2010	STA.01.02	A	M	M
Part B						
	11	2011	ALG.01.05	C	C	E
	12	2012	ALG.02.02	A	C	M
	13	2013	ALG.02.03	A	C	D
	14	2014	ALG.03.04	A	C	M
	15	2015	ALG.03.03	A	C	M
	16	2016	ALG.01.05	A	C	M
Part C						
	17	2017	ALG.02	P	E	M
	18	2018	ALG.02	P	E	M
	19	2019	ALG.02	P	E	M
	20	2020	ALG.03	P	E	M
	21	2021	ALG.02	P	E	D
	22	2022	GEO.01	P	E	M
	23	2023	GEO.01	P	E	D
	24	2024	ALG.02	P	E	D
	25	2025	STA.01	P	E	M

**Legend****S: Skill**A: Application  
C: Concept  
P: Problem solving**T: Type of items**C: Short-constructed answer  
E: Extended answer (developed response)  
M: Multiple choice**D: Level of Difficulty**E: Easy  
M: Medium  
D: Difficult

**3. INSTRUCTIONS FOR TEACHERS**

- Ensure that each student has all the material needed.
- Hand out the Question Booklets and read the instructions aloud to the students.
- Collect all booklets at the end of the examination.

**4. CORRECTION KEY**

<b>Part A</b>	
<b>Questions 1 to 10</b>	<b>4 marks or 0 marks</b>

<b>1</b>	D	<b>6</b>	B
<b>2</b>	B	<b>7</b>	D
<b>3</b>	C	<b>8</b>	D
<b>4</b>	C	<b>9</b>	A
<b>5</b>	B	<b>10</b>	D

<b>Part B</b>	
<b>Questions 11 to 16</b>	<b>4 marks each</b>

- 11** a) Rule:  $P = 40x + 20y$
- ▶ 2 marks All or nothing
- b) Points: A, B, C, D
- ▶ 2 marks All or nothing

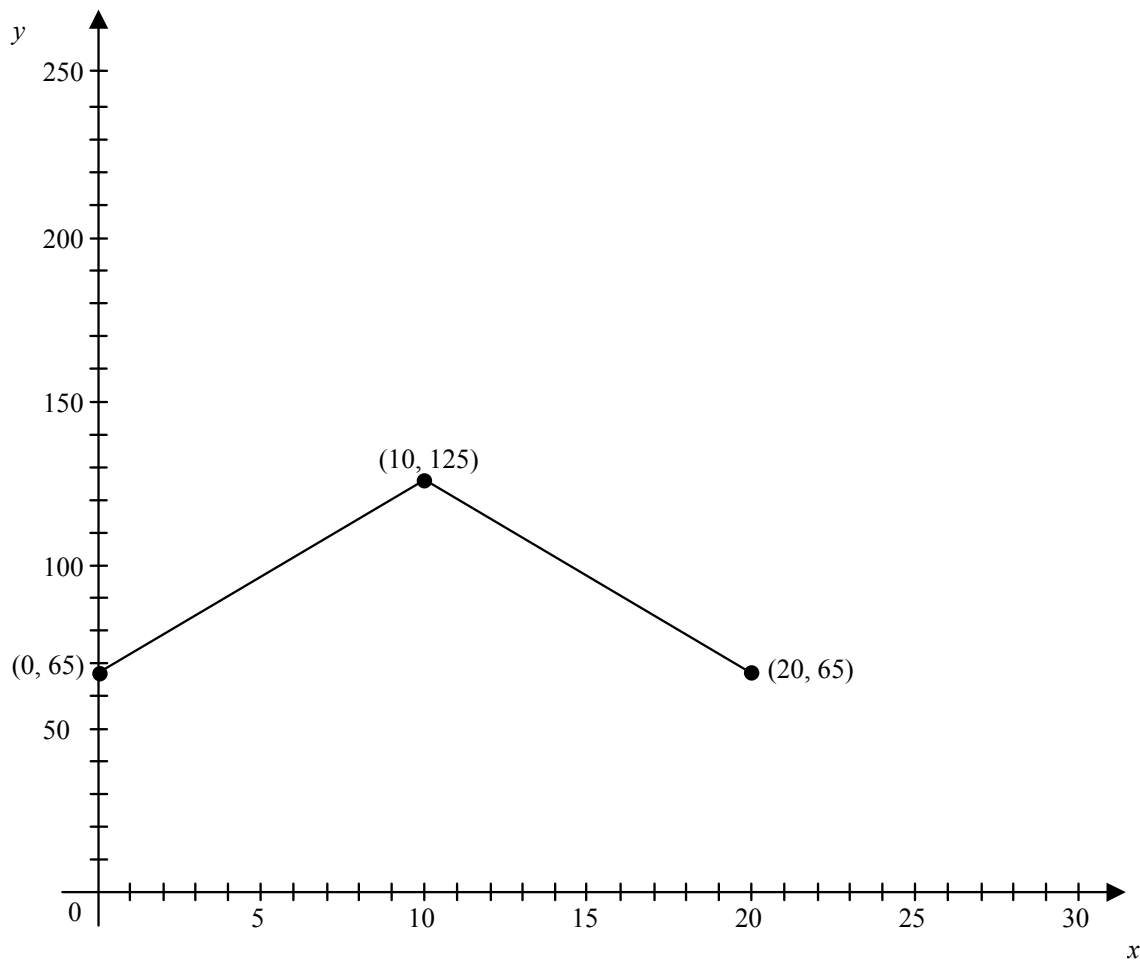
/4

Note: Do not penalize students who did not identify point A as one of the points.

12

/4

a)



▶ 2 marks for graph

▶ Deduct 1 mark for incorrect vertex  
 1 mark for incorrect initial value  
 1 mark for exceeding domain, to a maximum of 2 marks

b)

$$y = a|x - h| + k$$

$$y = a|x - 10| + 125$$

$$65 = a|0 - 10| + 125$$

$$-60 = 10a$$

$$-6 = a$$

$$y = -6|x - 10| + 125$$

Answer: The rule of the function is  $y = -6|x - 10| + 125$ .

▶ 2 marks for an appropriate method and correct answer

▶ 1 mark for an appropriate method only

**13**

Example of an appropriate method

/4

$$f(x) = 3(4)^{x-1} - 6$$

1 mark

set  $y = 0$ 

$$3(4)^{x-1} = 6$$

$$4^{x-1} = 2$$

$$(2^2)^{x-1} = 2$$

$$(2^2)^{x-2} = 2^1$$

}

1 mark

$$\therefore 2x - 2 = 1 \quad \}$$

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

1 mark

Interval in which the function is positive:  $\left[\frac{3}{2}, +\infty\right[$ 

1 mark

Note: Accept  $x \geq 1.5$ **14**

Example of an appropriate method

/4

$$\frac{1 + \sin x + 1 - \sin x}{1 - \sin^2 x} \text{ (simplify)}$$

1 mark

$$\frac{2}{1 - \sin^2 x} \text{ (simplify)}$$

1 mark

$$\frac{2}{\cos^2 x}; \text{ replace } (1 - \sin^2 x) \text{ by } \cos^2 x$$

1 mark

 $2 \sec^2 x$  (reciprocal identity)

1 mark

$$\therefore \frac{1}{1 - \sin x} + \frac{1}{1 + \sin x} = 2 \sec^2 x$$

**15**

Example of an appropriate method

/4

$$\log_3 (x + 2) + \log_3 x = 1$$

$$\log_3 (x^2 + 2x) = 1$$

$$x^2 + 2x = 3$$

$$x^2 + 2x - 3 = 0$$

$$(x + 3)(x - 1) = 0$$

$$x = -3 \text{ or } x = 1$$

$$x = 1 \text{ only}$$

1 mark

1 mark

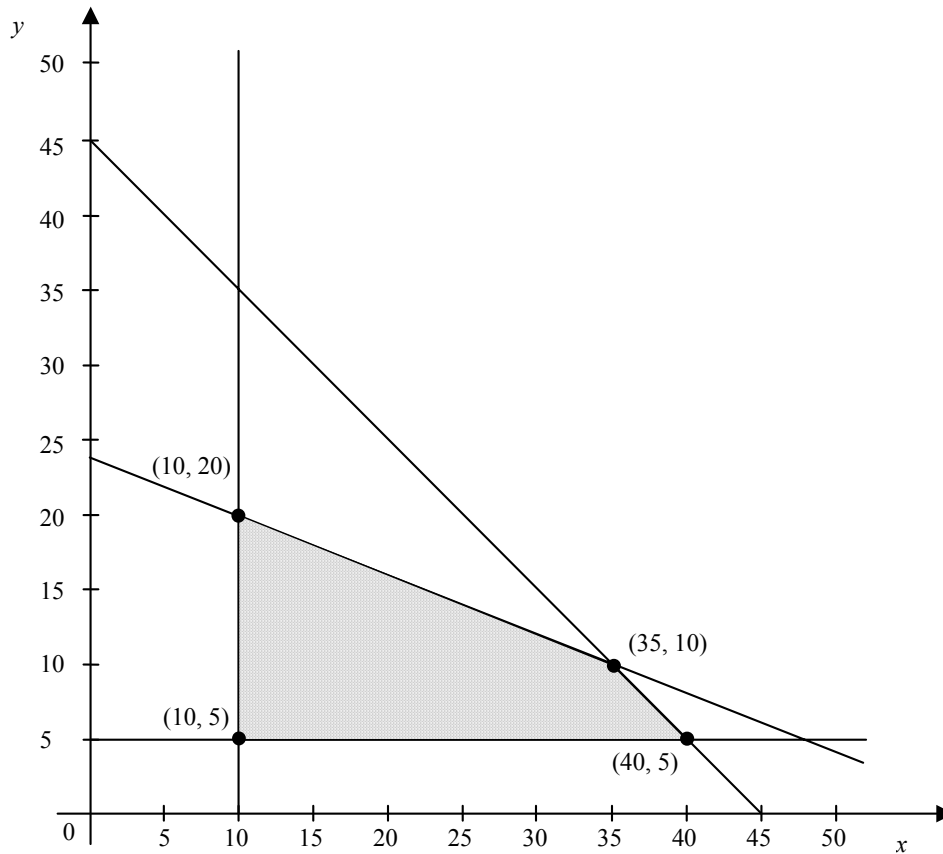
1 mark

1 mark

16

Example of an appropriate method

/4



2 marks for graph drawn correctly

Ext.	Profit = $6.5x + 10y$	} 1 mark
(10, 5)	\$115.00	
(10, 20)	\$265.00	
(40, 5)	\$310.00	
(35, 10)	\$327.50 MAX PROFIT	1 mark

Answer: The maximum revenue the gondola service can make is **\$327.50**.





### Marking scale for developed-response questions

1. Unless otherwise indicated, the marking scale on the following page will be used to grade questions 17 to 25, the developed-response questions in the examination. Adherence to the scale will help ensure equity for all students who write the examination.
2. Students' work will be analyzed carefully and then evaluated according to the criteria defined below.
3. **Information that includes graphs, and/or tables produced using a graphing calculator must be presented in the Answer Booklet.**
4. **Students who do not show their work will be given no marks for a correct final answer.**

### Definition of the Terms Found in the Marking Scale

#### Appropriate method

A logical procedure that makes it possible to solve the problem.

A student's method is deemed appropriate if the steps presented could lead to the solution.

A method may be deemed appropriate even if the final answer is incorrect. For instance, a student may make one or more mistakes in applying the relevant operations and relations, yet his or her method may still be considered appropriate.

A method may be deemed appropriate even if some of the required steps are not fully shown. In this case, students lose marks because their written information is not clear.

#### Partially appropriate method

A logical procedure that will not solve the problem, but which shows that the student has a partial understanding of the problem.

A method may still be considered partially appropriate even if the student makes mistakes in applying operations and relations, or even if his or her written information is not very clear.

#### Inappropriate method

A procedure that will not solve the problem and which shows no evidence that the student has any understanding of the problem. Students who do not show their work are deemed to have used an inappropriate method.

#### Correct application of operations and relations

The student made no mistakes in applying the chosen operations and relations.

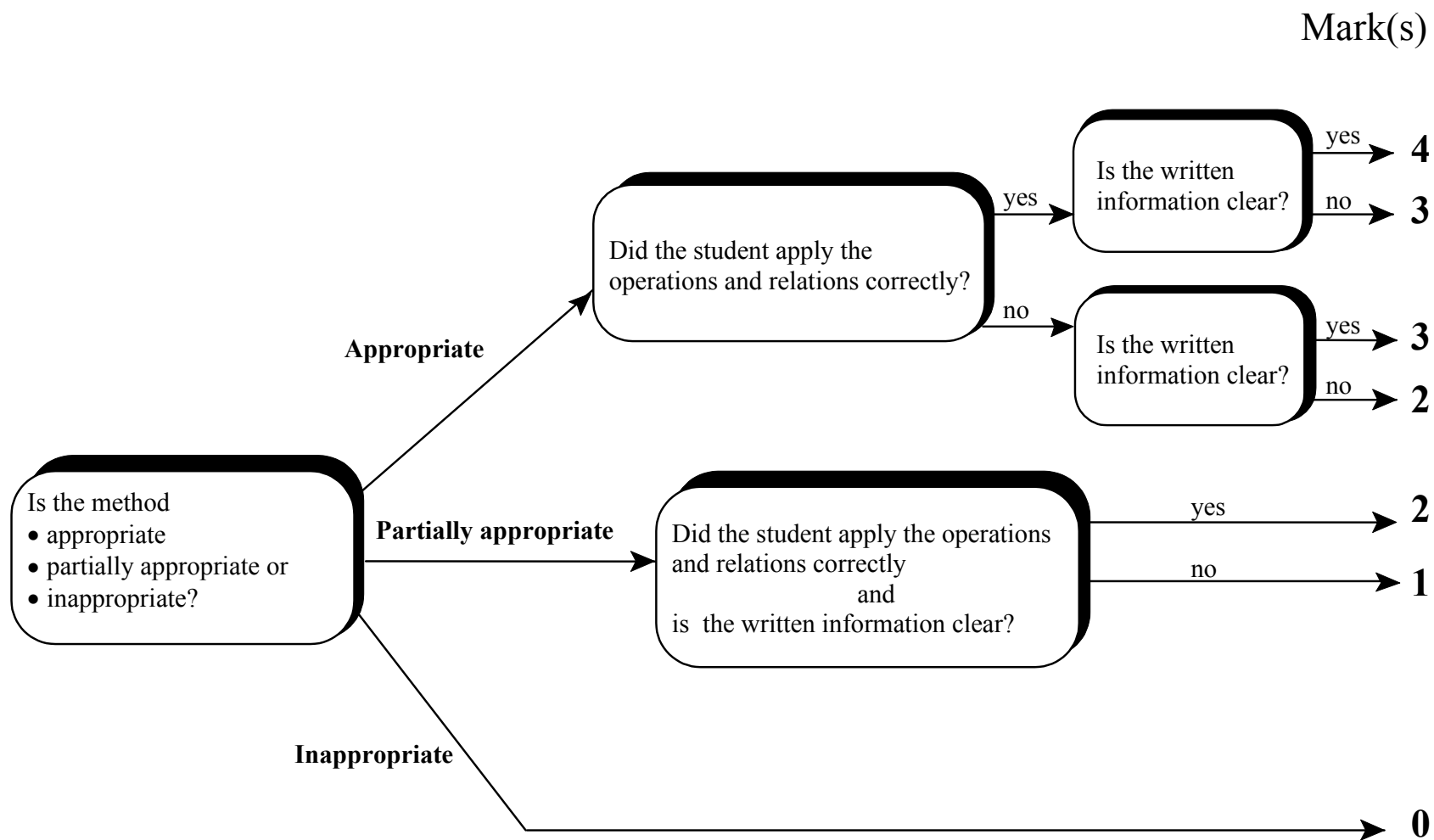
#### Clear written information

The information is complete, legible and presented using correct language.

The written information is clear when the scorer does not need to interpret the student's work.

To help the scorer, some developed-response questions specify what constitutes a partially appropriate method.

**MARKING SCALE**





## Part C

Questions 17 to 25      4 marks each

No marks are to be given if work is not shown. Examples of correct solutions are given.  
However, other acceptable solutions are possible.

17

Example of an appropriate method

/4

Given

$$\text{TELNORE} = a|x - h| + k$$

$$\text{Vertex at } (60, 250)$$

$$t(x) = a|x - 60| + 250$$

$$\text{Sub in } (0, 100)$$

$$100 = a|(0) - 60| + 250$$

$$-150 = 60a$$

$$a = -2.5$$

$$\therefore \text{TELNORE's Stock Price} = -2.5|x - 60| + 250$$

If same price after 90 weeks

$$t(90) = -2.5|(90) - 60| + 250$$

$$t(90) = 175$$

BU&U is linear (constant rate)

$$B(x) = mx + b$$

$$b = 40 \text{ (given)}$$

$$M = \frac{175 - 40}{90 - 0} = 1.5$$

$$B(x) = 1.5x + 40$$

$$\therefore t(130) = -2.5|(130) - 60| + 250$$

$$= 75$$

$$B(130) = 1.5(130) + 40$$

$$= 235$$

Difference

$$235 - 75 = 160$$

Answer: The difference in the price of their stock shares after 130 weeks is **\$160**.

**18**

Example of an appropriate method

/4

Finding the value of  $b$ 

$$\frac{2\pi}{120} = \frac{\pi}{60}$$

$$\text{Rule: } y = 3000 \cos\left(\frac{\pi}{60}x\right)$$

$$y = 3000 \cos\left(\frac{\pi}{60}(500)\right)$$

$$y = 1500$$

Answer: The satellite is **1500** km **North** of the equator.**19**

Example of an appropriate method

/4

Age of the van after 3 years

Let  $r =$  rate of depreciation

$$9615 = 28\,000 \times r^3$$

$$r^3 = \frac{9615}{28\,000} = 0.343$$

$$r = \sqrt[3]{0.343} = 0.7$$

Let  $t =$  number of years of depreciation

$$4000 = 28\,000 \times 0.7^t$$

$$0.7^t = 0.1429$$

Taking Logs:  $t \log 0.7 = \log 0.1429$ 

$$t = \left(\frac{\log 0.1429}{\log 0.7}\right) = 5.45$$

Answer: The van will be **5.5** years old, to the nearest tenth of a year.

Note: Do not penalize students who did not round off their final answers or who made a mistake in rounding.

20

Example of an appropriate method

/4

$$y = 2 \sin\left(x + \frac{\pi}{4}\right)$$

$$y = 1$$

$$2 \sin\left(x + \frac{\pi}{4}\right) = 1$$

$$\sin\left(x + \frac{\pi}{4}\right) = \frac{1}{2}$$

$$\left(x + \frac{\pi}{4}\right) = \frac{\pi}{6}$$

$$\text{or } x + \frac{\pi}{4} = \frac{5\pi}{6}$$

$$\text{or } x + \frac{\pi}{4} = \frac{13\pi}{6}$$

$$x = \frac{-\pi}{12}$$

$$x = \frac{7\pi}{12}$$

$$\text{or } x = \frac{23\pi}{12}$$

 for the domain  $x \in [0, 2\pi]$ 

$$x = \frac{7\pi}{12} \quad \text{or } x = \frac{23\pi}{12}$$

Answer: The points of intersection are:  $\left(\frac{7\pi}{12}, 1\right)$  and  $\left(\frac{23\pi}{12}, 1\right)$

Note: Algebraic or graphic solutions are acceptable.

Do not penalize students who wrote only the  $x$  coordinates, i.e.,  $\frac{7\pi}{12}$  and  $\frac{23\pi}{12}$ .

21

Example of an appropriate method

/4

Given:

$$f(x) = \sqrt{x-4} + 4$$

$$g(x) = a\sqrt{x-h} + k$$

from C1:

$$g(x) = a\sqrt{x-0} + 2$$

$$f(8) = g(8)$$

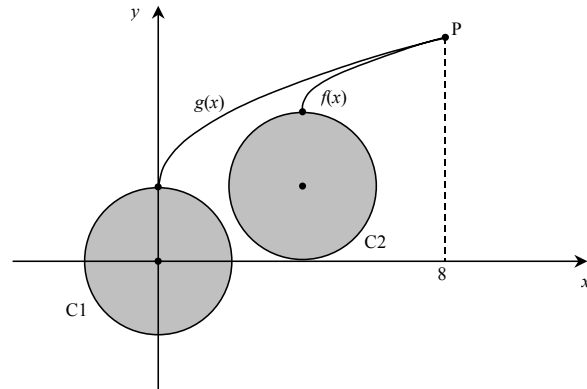
$$\sqrt{8-4} + 4 = a\sqrt{8} + 2$$

$$4 = a\sqrt{8}$$

$$a = \frac{4}{\sqrt{8}}$$

$$= \frac{4\sqrt{8}}{8} = \frac{\sqrt{8}}{2} = \frac{2\sqrt{2}}{2} = \sqrt{2}$$

$$\therefore g(x) = \sqrt{2x} + 2$$



Answer: The rule of  $g(x)$  is  $\sqrt{2x} + 2$ .

Accept also  $g(x) = \sqrt{2}\sqrt{x} + 2$  or  $g(x) = 1.41\sqrt{x} + 2$



22

Example of an appropriate method

/4

$$\frac{m \overline{AB}}{m \overline{AD}} = \frac{m \overline{BC}}{m \overline{CD}}$$

$$\frac{12}{5} = \frac{m \overline{BC}}{7}$$

$$m \overline{BC} = 16.8 \text{ cm}$$

$$(m \overline{BC})^2 = (m \overline{AB})^2 + (m \overline{AC})^2 - 2(m \overline{AB})(m \overline{AC})\cos A$$

$$16.8^2 = 12^2 + 12^2 - 2(12)(12)\cos A$$

$$\cos A \approx 0.02$$

$$A \approx 88.9^\circ$$

Answer: Angle BAC measures **88.9°**. (Accept 89°)

Note: Students who have found the measure of segment BC to be 16.8 cm have shown partial understanding of the problem.

23

Example of an appropriate method

/4

$$m \overline{BE} \cdot m \overline{ED} = m \overline{CE} \cdot m \overline{EA}$$

$$30 \cdot m \overline{ED} = 56 \text{ cm} \cdot 34 \text{ cm}$$

$$m \overline{ED} = \frac{952}{15} = 63.4\overline{6}$$

$$m \overline{BD} = 30 + 63.4\overline{6} = 93.4\overline{6}$$

In  $\triangle BEC$  (right triangle)

$$(m \overline{CE})^2 = (m \overline{BE})^2 + (m \overline{BC})^2$$

$$56^2 = 30^2 + (m \overline{BC})^2$$

$$m \overline{BC} \approx 47.29$$

In  $\triangle BDC$  (right triangle)

$$(m \overline{CD})^2 = (m \overline{BC})^2 + (m \overline{BD})^2$$

$$= 47.29^2 + 93.47^2$$

$$= 2236.34 + 8736.64$$

$$\approx 10\,972$$

$$m \overline{CD} \approx 104.75$$

$$\text{radius} = \frac{104.75}{2} \approx 52.4$$

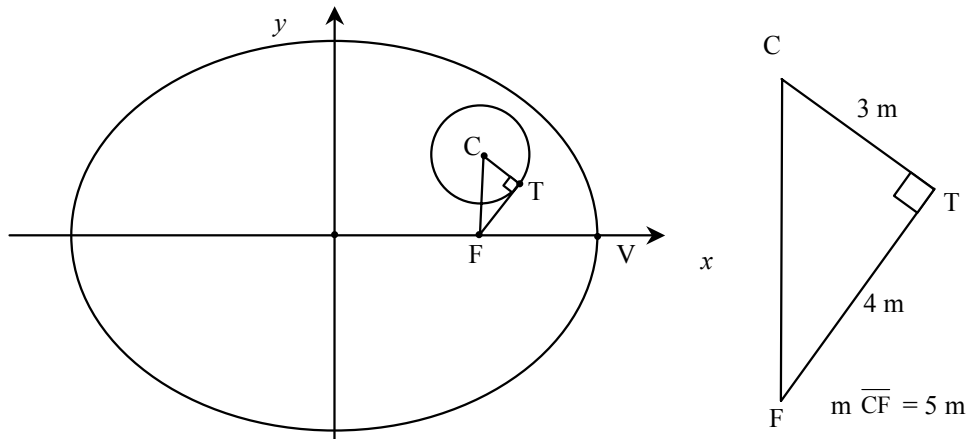
Answer: The length of the radius is **52.4 cm**.

Note: Do not penalize students who did not round off their final answer or who made a mistake in rounding it off.

24

Example of an appropriate method

/4



Equation of ellipse

$$\frac{x^2}{625} + \frac{y^2}{400} = 1$$

The center is the origin:

$$\text{length of major axis: } \sqrt{625} = 25$$

$$\text{length of minor axis: } \sqrt{400} = 20$$

$$c = \sqrt{625 - 400} = 15 \quad \text{coordinate of focus } (15, 0)$$

Horizontal translation of circle = 15 units to the right  
(since the center of the circle is directly above the focus.)

$\overline{FT}$  is tangent to the circle at point T

$\therefore m \angle CTF = 90^\circ$ ; and  $m \overline{CF} = 5$  units  
(vertical translation of 5 units upwards)

Answer: The equation of the circle is  $(x - 15)^2 + (y - 5)^2 = 9$ .



25

Example of an appropriate method

/4

Whelan High School

$$\text{Mean} = 76\%$$

$$\text{Std. Deviation} = 6.44$$

James's Z-score is 0.60

$$\begin{aligned}\therefore 0.60 &= \frac{x - 76}{6.44} \\ &= 80\% \text{ (James's Mark)}\end{aligned}$$

Goodwood High School

$$\text{Mean} \approx 68.18\%$$

Std. Deviation = 9.51 (Population SD) or 9.738 (Sample SD)

Mary's mark is 80%

$$\begin{aligned}\therefore \text{Mary's Z-score} &= \frac{80 - 68.18}{9.51} \quad \text{or} \quad \frac{80 - 68.18}{9.738} \\ &= 1.24 \quad \text{or} \quad 1.23\end{aligned}$$

Answer: Since Mary obtained a higher Z-score than James, then she definitely should be accepted into the program before he is considered.





**568-526**

Mathematics

**Comprehensive Exam  
Number 53**

Question Booklet

Secondary 5

September 2003



**Youth Sector General Education**



## INSTRUCTIONS

1. Write the required information on the cover page of your Answer Booklet.
2. Answer all 25 questions in the Answer Booklet.
3. You have 3 hours to complete the exam.
4. Each question is worth 4 marks.
5. You may use a calculator (with or without graphing display), and a memory aid sheet.
6. The following materials are allowed: graph paper, ruler, compass, set square and protractor.
7. The figures in this booklet have NOT necessarily been drawn to scale.
8. At the end of the exam period, hand in the Question Booklet and Answer Booklet.

**Part A Questions 1 to 10**

In the Answer Booklet, blacken the letter that corresponds to the answer chosen.

**1**

Anne Marie is an animal groomer who charges \$40 to groom a cat and \$50 to groom a dog.

For her business to prosper, she must have a minimum gross income of \$650 a day. Normally she grooms at least twice as many dogs as cats.

$c$ : number of cats that she grooms

$d$ : number of dogs that she grooms

**Which of the following sets of constraints represents Anne Marie's situation?**

A)  $50d + 40c \leq 650$   
 $2d \geq c$   
 $c \geq 0$   
 $d \geq 0$

C)  $50d + 40c \geq 650$   
 $d \leq 2c$   
 $c \geq 0$   
 $d \geq 0$

B)  $50d + 40c \leq 650$   
 $2d \leq c$   
 $c \geq 0$   
 $d \geq 0$

D)  $50d + 40c \geq 650$   
 $d \geq 2c$   
 $c \geq 0$   
 $d \geq 0$

**2**

Given the square root function:  $f(x) = -\sqrt{x + 7} + 3$ .

**Which of the following statements is FALSE?**

- A) The domain is  $[-7, +\infty[$ .
- B) The range is  $[3, +\infty[$ .
- C) The coordinates of the vertex are  $(-7, 3)$ .
- D) The zero of the function is 2.

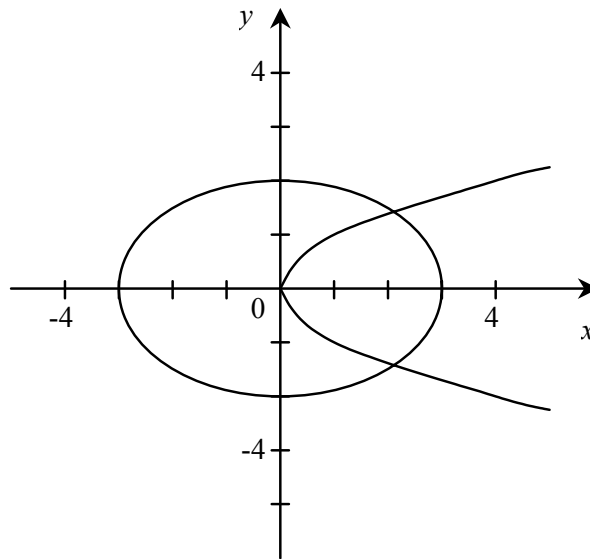
3

Which of the following is the locus of a point for which the absolute value of the difference between the distances from two fixed points is constant?

- A) Circle  
 B) Ellipse  
 C) Hyperbola  
 D) Parabola

4

The graph of an ellipse and a parabola are drawn below.



Which of the following equations could represent these two curves?

- A)  $\frac{x^2}{9} + \frac{y^2}{4} = 1$   
 $x^2 = y$
- B)  $\frac{x^2}{9} - \frac{y^2}{4} = 1$   
 $x^2 = y$
- C)  $\frac{x^2}{9} + \frac{y^2}{4} = 1$   
 $y^2 = x$
- D)  $\frac{x^2}{9} - \frac{y^2}{4} = 1$   
 $y^2 = x$

**5** Which of the following are the equations of the asymptotes for the rational function below?

$$f(x) = \frac{8x - 20}{4x + 2}$$

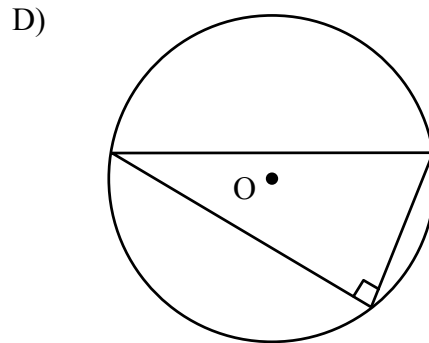
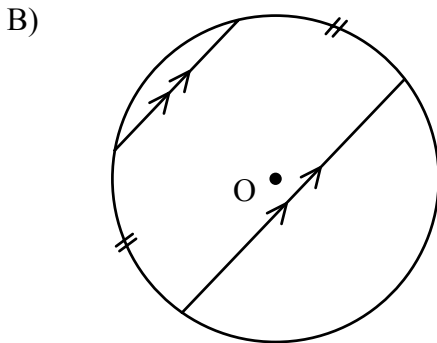
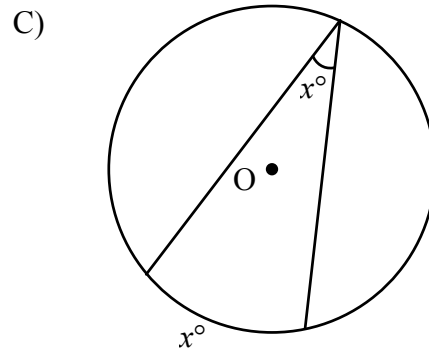
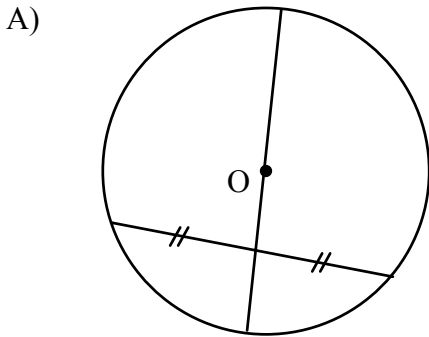
A)  $x = \frac{1}{2}$   
 $y = \frac{1}{2}$

C)  $x = -2$   
 $y = 2$

B)  $x = -\frac{1}{2}$   
 $y = 2$

D)  $x = 2$   
 $y = -\frac{1}{2}$

**6** Which of the following diagrams represents a valid geometric property of circles? (O is the centre of each circle.)

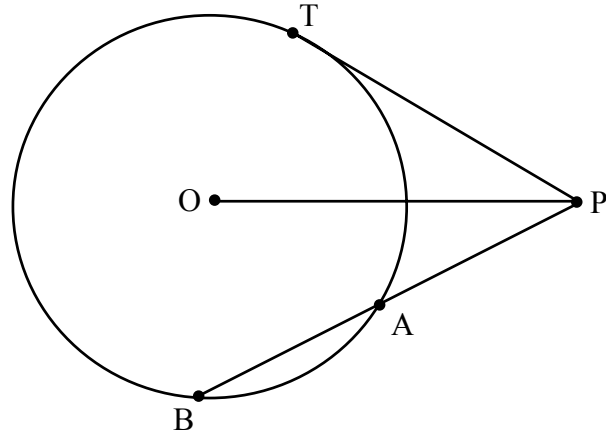


7

In the circle on the right with centre O:

- the radius is 9 dm
- $\overline{PT}$  is tangent to the circle and T is the point of tangency
- $m \overline{PA} = 9$  dm
- $m \overline{AB} = 7$  dm

What is the measure of segment PO?



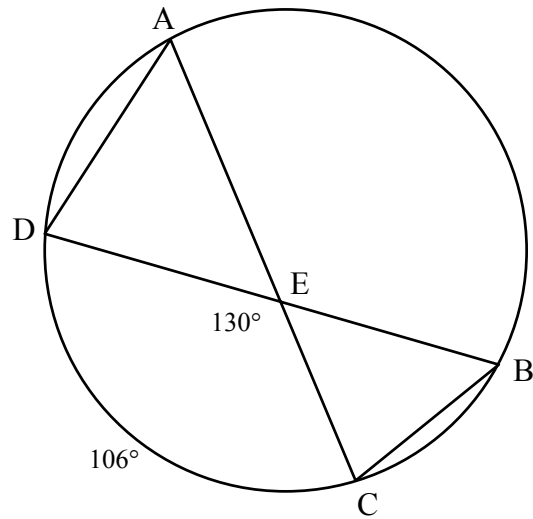
- |            |          |
|------------|----------|
| A) 18.4 dm | C) 16 dm |
| B) 17 dm   | D) 15 dm |

8

In the figure on the right:

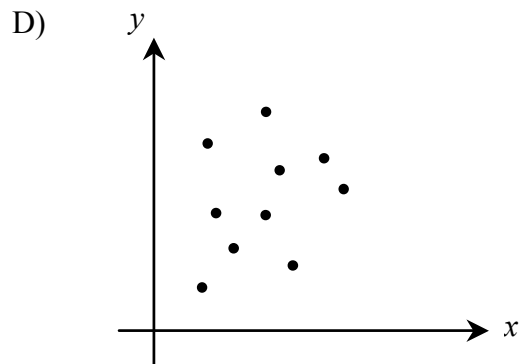
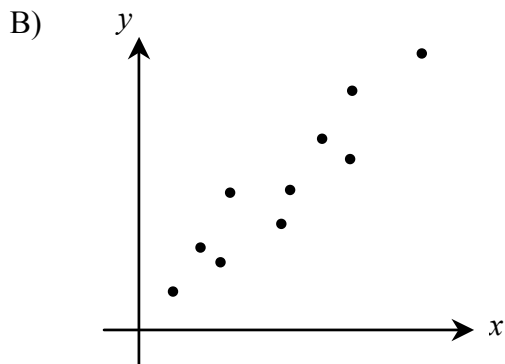
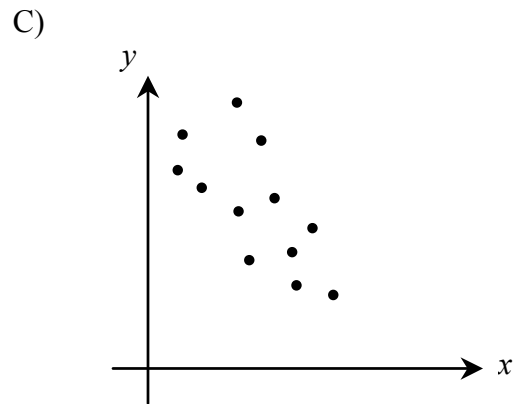
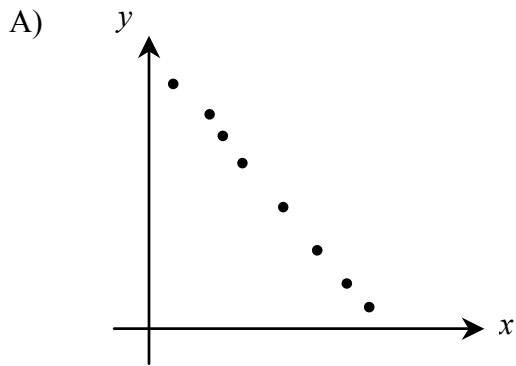
- $\overline{AC}$  and  $\overline{DB}$  intersect at point E
- $m \angle DEC = 130^\circ$
- $m \widehat{DC} = 106^\circ$

Which of the following is true?



- |                            |                                 |
|----------------------------|---------------------------------|
| A) $m \angle A = 50^\circ$ | C) $m \widehat{AD} = 74^\circ$  |
| B) $m \angle C = 65^\circ$ | D) $m \widehat{AB} = 154^\circ$ |

9 Which of the scatter plot diagrams below represents the strongest correlation?





**10** William and Xavier are both in Mr. Abercrombie's Math 526 class. Their class average on the last term exam was 72%, with a standard deviation of 5. Yannick and Zeus are in Mrs. Belanger's Math 526 class. On the same exam, their class average was 81% with a standard deviation of 10.

Because some coffee had been spilled on the student marks sheet, only the following information could be seen:

- William's Z-score is  $-1$ .
- Xavier's class mark is 77%.
- Yannick has the same Z-score as Xavier.
- Zeus's Z-score is  $-0.4$ .

**Given this information, which of the following statements is TRUE?**

- A) William's class mark is lower than 66%.
- B) Zeus's class mark and William's class mark differ by 7%.
- C) Yannick's class mark is less than 90%.
- D) Xavier and Zeus got the same class mark.



**Part B Questions 11 to 16**

Show all appropriate work.

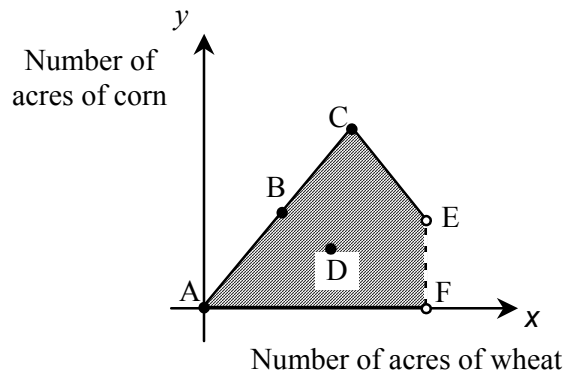
Even if your answer is correct, no marks will be given unless acceptable work is shown.

Write your answer in the space provided in the answer booklet.

- 11** Mrs. Thomas owns 40 acres of farmland. She produces less than 30 acres of wheat and a maximum of 20 acres of corn. She grows at least as much wheat as corn. The wheat is sold at a profit of \$40 per acre, while the corn is sold at a profit of \$20 per acre.

$x$  : number of acres of wheat  
 $y$  : number of acres of corn

The polygon of constraints is represented by a quadrilateral, shown on the right.



- a) **What is the rule of the objective function?**
- b) **Which points, represented by letters, are in the solution set?**
- 12** Kevin worked out at the gym and monitored his heart rate every minute he was there. When he began his workout, his heart rate was 65 beats per minute. After he had used the treadmill for 10 minutes, his heart rate had risen to a maximum of 125 beats per minute. Then he rested for 10 minutes, after which his heart rate had returned to 65 beats per minute.

When he graphed this situation, the result was an absolute value function.

- a) **Draw the graph with the given data.**
- b) **Determine the rule of this function.**



**13** Given the rule of the transformed exponential function:  $f(x) = 300(4)^{x-1} - 600$ .

**What is the interval for which the function is positive?**

**14** Given that  $\sin x \neq \pm 1$ ,

**Prove the following trigonometric identity:**

$$\frac{1}{1 - \sin x} + \frac{1}{1 + \sin x} = 2 \sec^2 x$$

**15** Solve the following logarithmic equation for  $x$ .

$$\log_3 (x + 2) + \log_3 x = 1$$

**16** Mont Tremblant offers gondola rides to the top of the mountain. Children's tickets cost \$6.50 each and adult tickets cost \$10 each. On any given ride there will be at least 10 children and 5 adults. The gondola has room for a maximum of 45 passengers and can hold up to 1680 kg. The average mass of a child is 28 kg and that of an adult is 70 kg.

$x$  : number of children tickets sold

$y$  : number of adult tickets sold

Given:

$$x \geq 10$$

$$y \geq 5$$

$$x + y \leq 45$$

$$28x + 70y \leq 1680$$

**What is the maximum revenue the gondola service can make in one trip?**

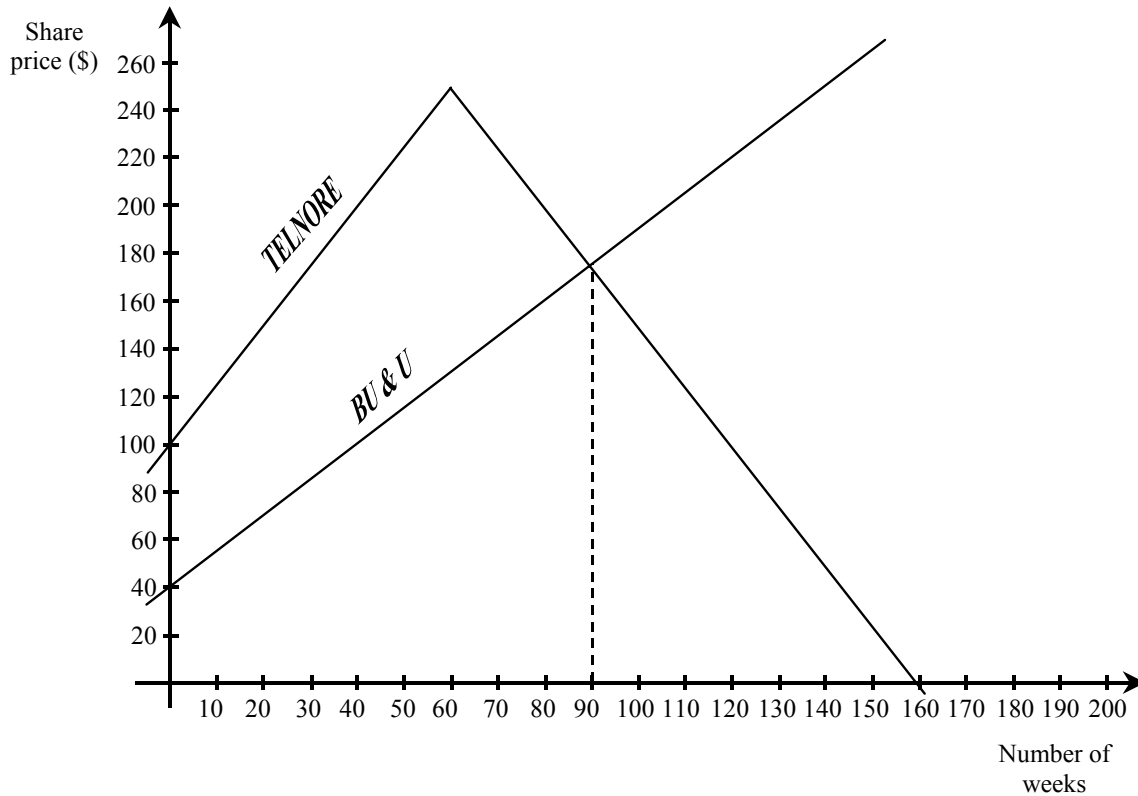
**Part C Questions 17 to 25**

- ▶ **Show all your work as well as your answer.** The work shown is taken into consideration when marks are awarded.
  - ▶ Your written information must be legible, complete, and clearly stated in correct language so the marker understands exactly what you have done.
- Even if your answer is correct, no marks will be given unless acceptable work is shown.**

**17** The price of stock shares of a telecommunications company, TELNORE, follows an absolute value function. TELNORE had an initial stock price of \$100 a share, which rose to its maximum price of \$250 after 60 weeks. Another telecommunications company, BU&U, opened on the stock market the same day as TELNORE. The BU&U stock share price has risen at a constant rate. BU&U opened on the stock market with shares that initially cost \$40 each.

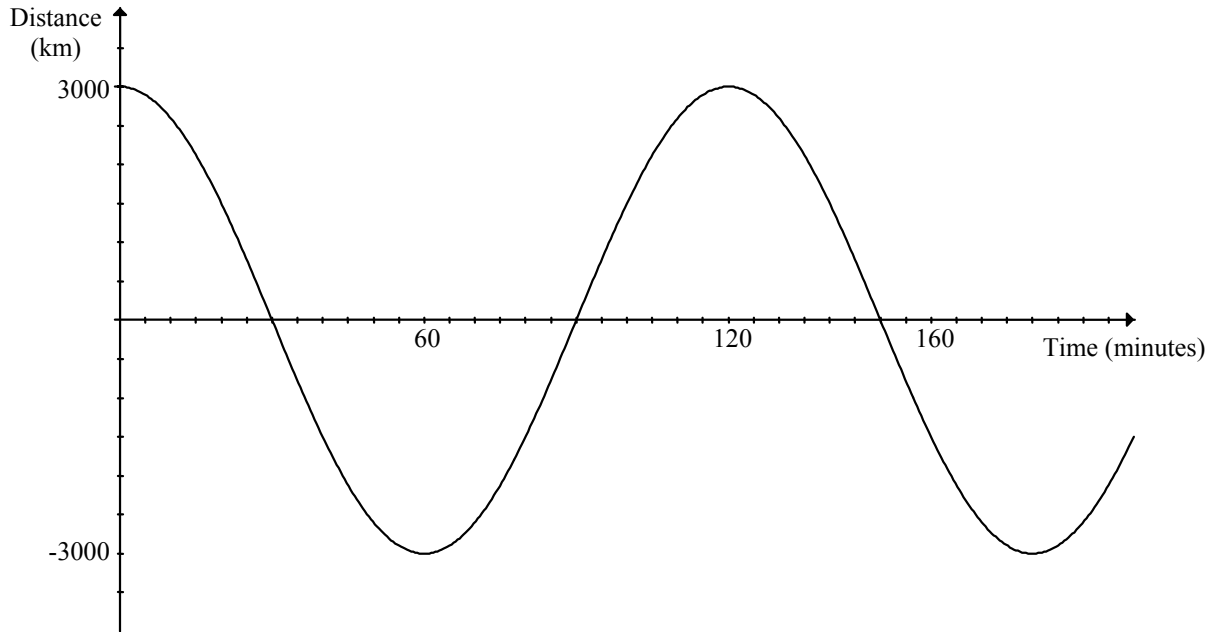
In the 90<sup>th</sup> week during which the companies' shares were sold on the stock market, their shares were selling for the same amount.

If the stock trading trends of both companies were to continue, **what would be the difference in the price of their stock shares after 130 weeks?**





- 18** A satellite that is launched into orbit from a point 3000 km north of the equator travels alternately north and south of the equator. This distance from the equator, as a function of time, resembles a cosine function, as shown in the diagram. The satellite travels 3000 km south of the equator before returning to a point 3000 km north of the equator in 120 minutes.



**How many kilometres north or south of the equator is the satellite after it has been in orbit for exactly 500 minutes?**

- 19** Denise purchased a new van in 1999 for a value of \$28 000. Three years later, the value of the van had dropped exponentially to the value of \$9615.

**How old will the van be when its value is \$4000?**

Express your answer to the nearest tenth of a year.

- 20** The graphs of  $y = 2 \sin \left( x + \frac{\pi}{4} \right)$  and  $y = 1$  will intersect at an infinite number of points.

**In the interval  $x \in [0, 2\pi]$ , state all points of intersection of these two graphs.**

- 21** FRANKENFOODS, a company specializing in genetically modified fruits, has designed a corporate logo.

The logo is two cherries which are circles that have square root functions,  $f(x)$  and  $g(x)$ , as stems.

The equations of the circles are:

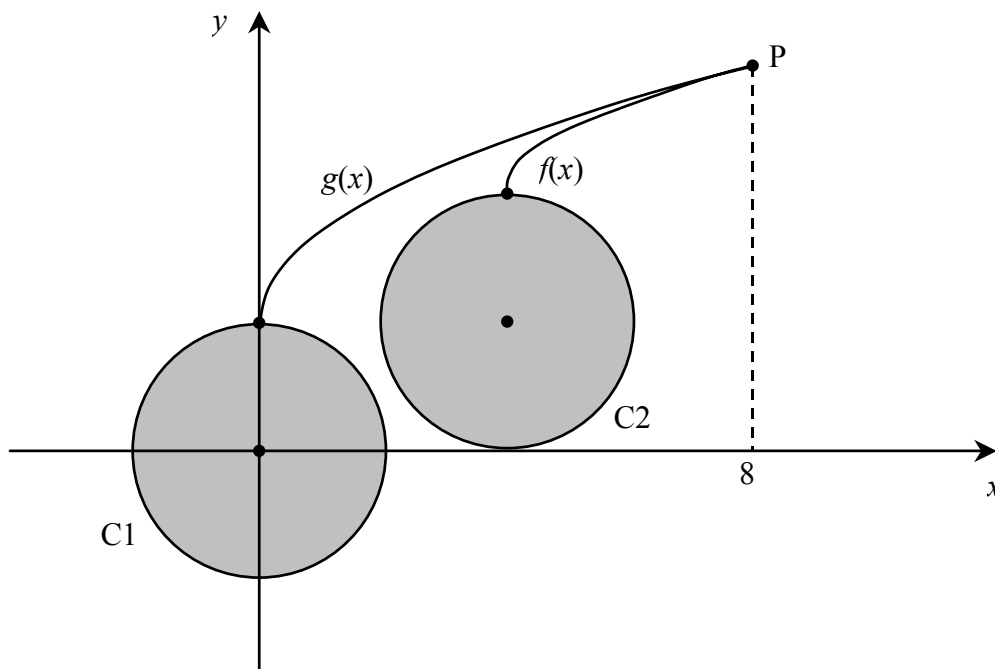
$$x^2 + y^2 = 4$$

and  $(x - 4)^2 + (y - 2)^2 = 4$

Stem  $f(x)$  is given by the equation  $f(x) = \sqrt{x - 4} + 4$ .

$f(x)$  and  $g(x)$  intersect at point  $P(8, y)$ .

**What is the rule of  $g(x)$ ?**





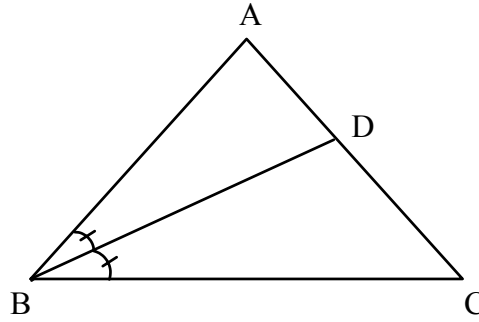
22

In the adjacent diagram,  $\overline{BD}$  is the bisector of  $\angle ABC$ ,

$$m \overline{AB} = 12 \text{ cm,}$$

$$m \overline{AD} = 5 \text{ cm, and}$$

$$m \overline{DC} = 7 \text{ cm.}$$



**What is the measure of angle BAC?**

23

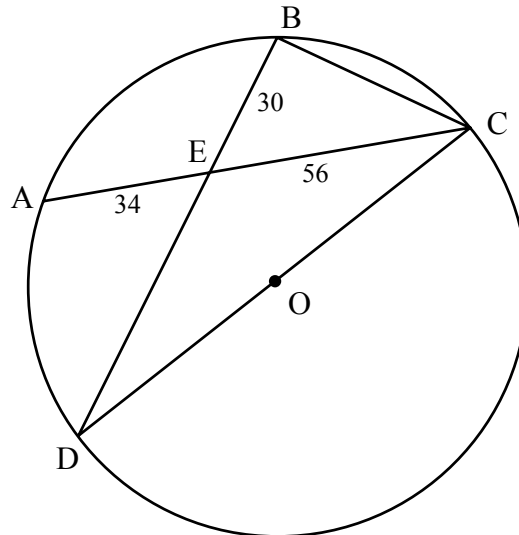
O is the centre of the circle on the right.

Chords AC and BD intersect at point E, such that:

$$m \overline{BE} = 30 \text{ cm}$$

$$m \overline{AE} = 34 \text{ cm}$$

$$m \overline{CE} = 56 \text{ cm}$$



**To the nearest tenth of a centimetre, what is the length of the radius of the circle?**



24

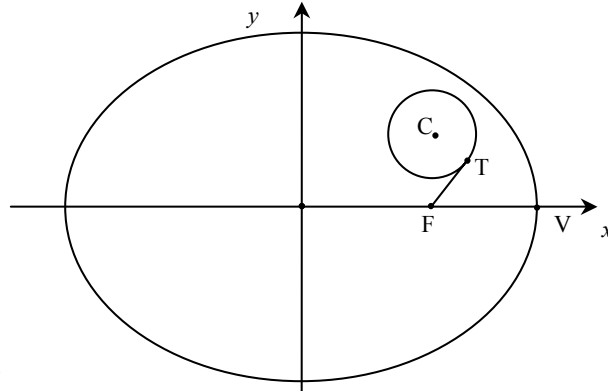
In the diagram on the right, the equation of the ellipse is  $\frac{x^2}{625} + \frac{y^2}{400} = 1$ .

The circle has a radius of 3 m.

The centre  $C$  of the circle is located directly above the focus  $F$  of the ellipse.

Line segment  $FT$  is tangent to the circle at point  $T$ .

$m \overline{FT} = 4$  m.



(The diagram is not drawn to scale.)

All unit measures are in metres.

**What is the equation of the circle?**

25

Mary, who attended Goodwood High School, received a very good mark in the Math 526 final exam. She applied for entrance into a Math program at a certain CEGEP, but was not accepted.

James applied to the same CEGEP for the same program and was accepted. He attended Whelan High School and his Z-score at was 0.60.

The chart below shows the results of the Math 526 final exam.

Goodwood High School Math 526 Results	Whelan High School Math 526 Results
52, 54, 54, 56, 58, 62, 62, 63	66, 66, 68, 69, 70, 72, 72
64, 66, 68, 69, 72, 72, 74, 76	73, 74, 75, 76, 77, 77, 80
76, 77, 80, 81, 82, 82	82, 82, 84, 85, 86, 86

Mary later found out that James had the same mark as she did in the Math 526 final exam. She filed a complaint to the CEGEP for having refused to accept her into the program.

**Based on Z-scores, explain how Mary could justify her complaint to the CEGEP.**



**568-526**

Mathematics

FOR TEACHER USE ONLY

Part A \_\_\_\_\_ /40

Part B \_\_\_\_\_ /24

Part C \_\_\_\_\_ /36

Total \_\_\_\_\_ /100

**Comprehensive Exam  
Number 53**

Answer Booklet

Secondary 5

September 2003

Student's Name

Group

Date



**Youth Sector General Education**





**Part A      Questions 1 to 10**

Blacken the letter that corresponds to the answer chosen.

**1** [A] [B] [C] [D]

**2** [A] [B] [C] [D]

**3** [A] [B] [C] [D]

**4** [A] [B] [C] [D]

**5** [A] [B] [C] [D]

**6** [A] [B] [C] [D]

**7** [A] [B] [C] [D]

**8** [A] [B] [C] [D]

**9** [A] [B] [C] [D]

**10** [A] [B] [C] [D]



**Part B      Questions 11 to 16**

Show all appropriate work.

Write your answer in the space provided.

**11**

2	0
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a) Rule: \_\_\_\_\_

2	0
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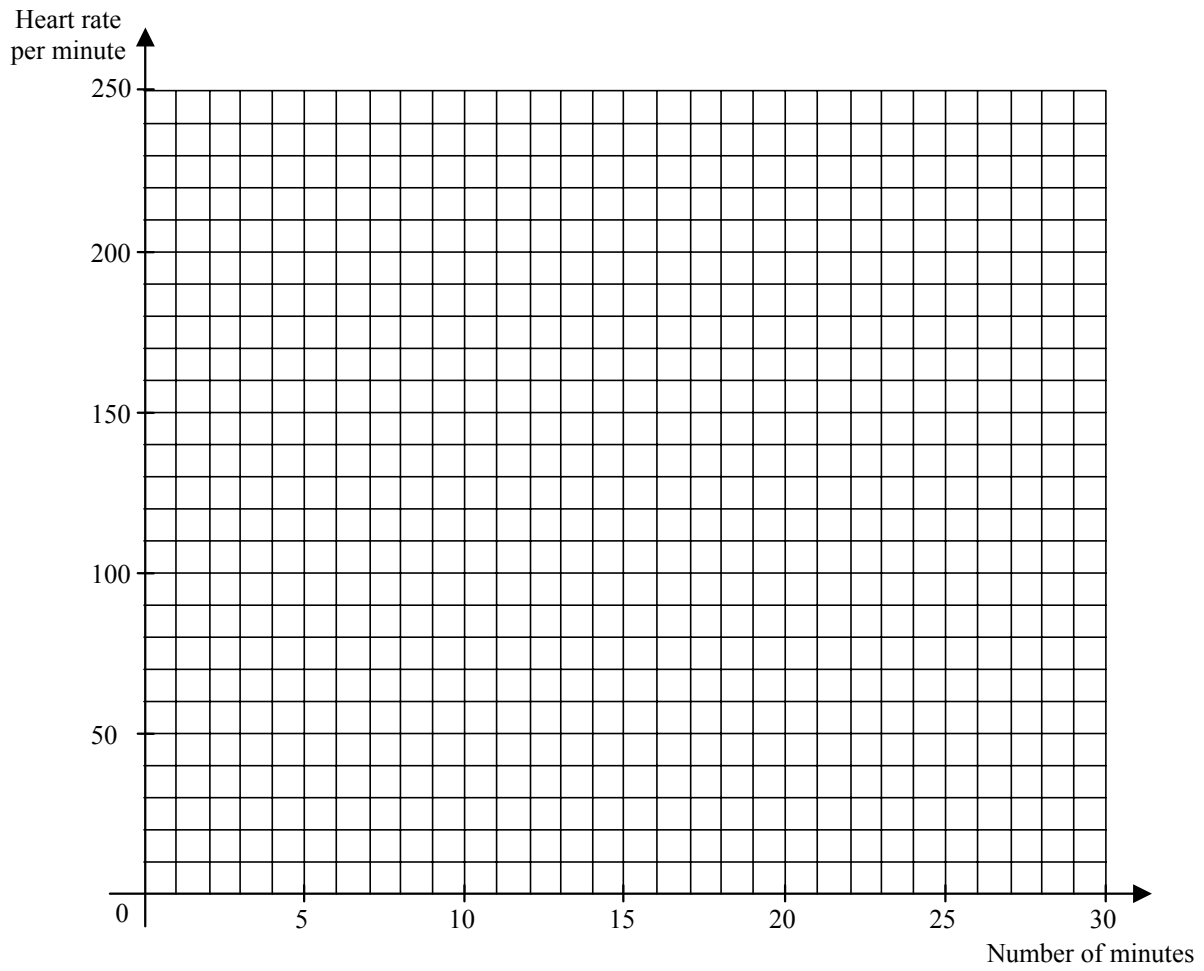
b) Points: \_\_\_\_\_



12

2	1	0
---	---	---

a)



2	1	0
---	---	---

b)

Answer: The rule of the function is \_\_\_\_\_.



13

4	3	2	1	0
---	---	---	---	---

Show all your work.

Answer: The interval in which the function is positive: \_\_\_\_\_.

14

4	3	2	1	0
---	---	---	---	---

Prove the following trigonometric identity:

$$\frac{1}{1 - \sin x} + \frac{1}{1 + \sin x} = 2 \sec^2 x$$



15

4	3	2	1	0
---	---	---	---	---

Show all your work.

$$\log_3(x + 2) + \log_3 x = 1$$



16

4	3	2	1	0
---	---	---	---	---

Show all your work.

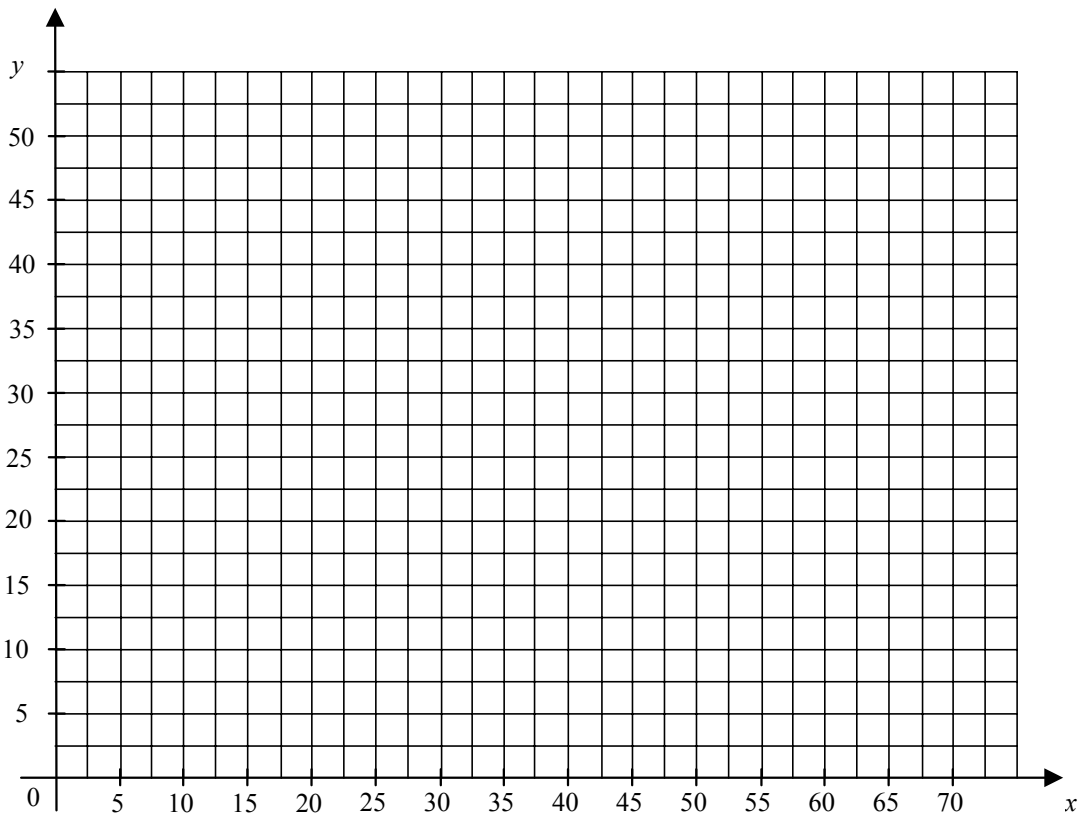
Given:

$$x \geq 10$$

$$y \geq 5$$

$$x + y \leq 45$$

$$28x + 70y \leq 1680$$



Answer: The maximum revenue the gondola service can make is \_\_\_\_\_.



**Part C      Questions 17 to 25**

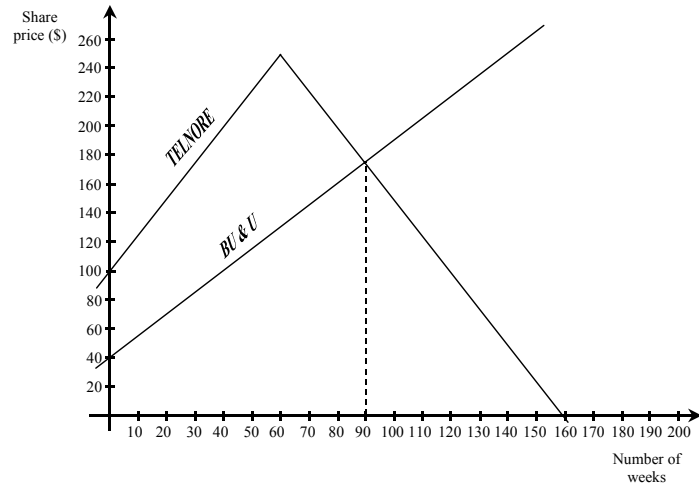
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17

4	3	2	1	0
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Show all your work.



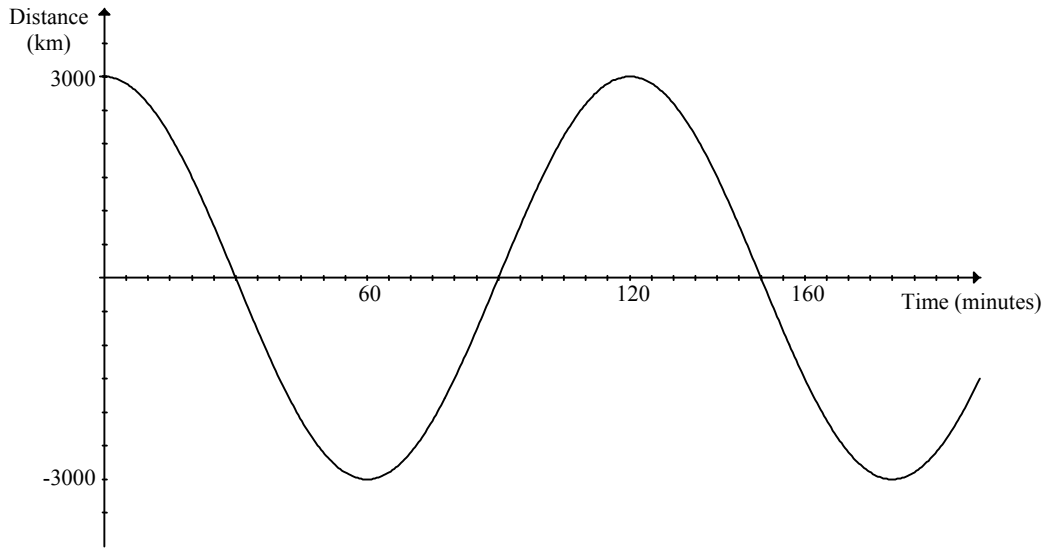
Answer: The difference in the price of their stock shares after 130 weeks is \$\_\_\_\_\_.



18

4	3	2	1	0
---	---	---	---	---

Show all your work.



Answer: The satellite is \_\_\_\_\_ km \_\_\_\_\_ of the equator.



19

4	3	2	1	0
---	---	---	---	---

Show all your work.

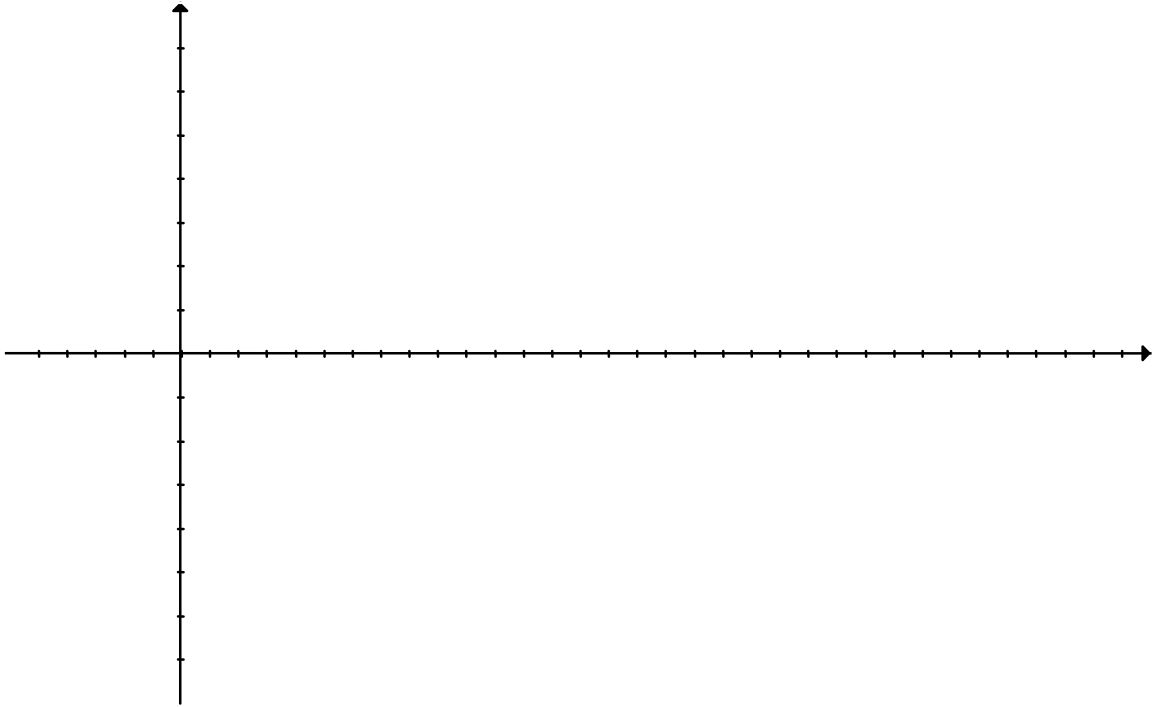
Answer: The van will be \_\_\_\_\_ years old, to the nearest tenth of a year.

20

4	3	2	1	0
---	---	---	---	---

Show all your work.

$$y = 2 \sin\left(x + \frac{\pi}{4}\right)$$
$$y = 1$$

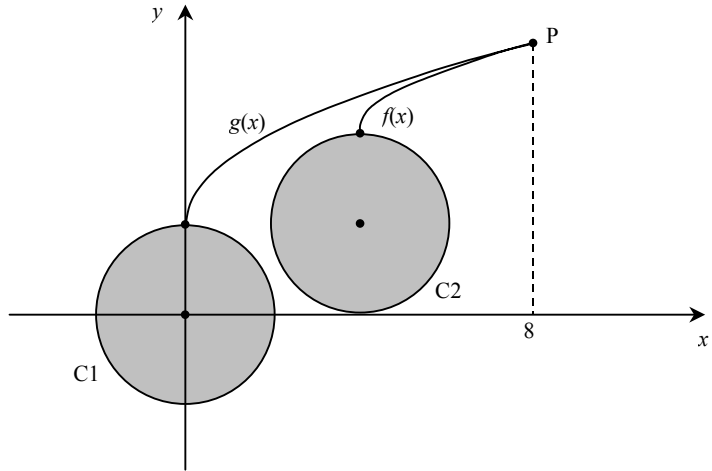


Answer: The points of intersection are \_\_\_\_\_.

21

4	3	2	1	0
---	---	---	---	---

Show all your work.

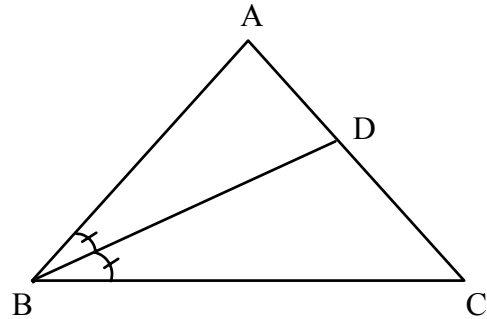


Answer: The rule of  $g(x)$  is \_\_\_\_\_.

22

4 3 2 1 0

Show all your work.

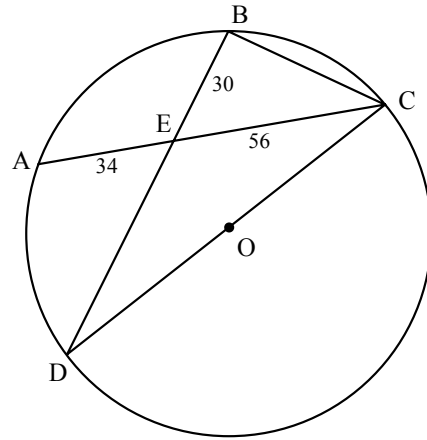


Answer: Angle BAC measures \_\_\_\_\_°.

23

4	3	2	1	0
---	---	---	---	---

Show all your work.

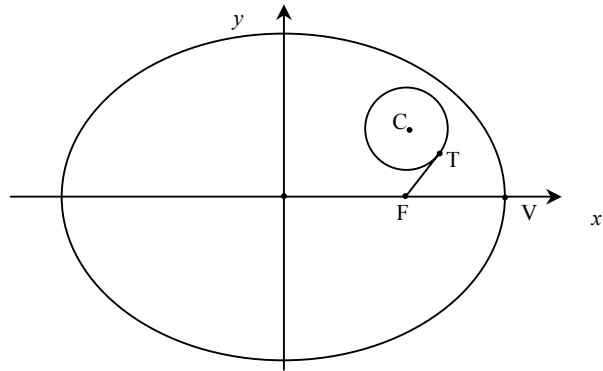


Answer: To the nearest tenth of a centimetre, the length of the radius is \_\_\_\_\_ cm.

24

4	3	2	1	0
---	---	---	---	---

Show all your work.



Answer: The equation of the circle is : \_\_\_\_\_.



25

4	3	2	1	0
---	---	---	---	---

Show all your work.

Explanation:

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