

MATHEMATICS 3000

Preparation
for
Ministry Exams

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**ADJUSTED
PROGRAM**

Cultural, Social and Technical Option
Secondary 4



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Adjusted Program

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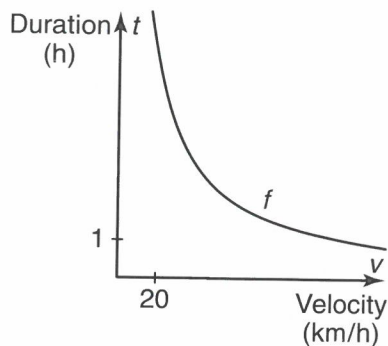
PHOTOCOPYING KILLS BOOKS



EXAM 5

SECTION A

1. The rational function f represented in the given graph associates, to the velocity v , in km/h, of a train, the duration t , in hours, of the trip. This train takes 90 minutes to cover the distance at a speed of 80 km/h.



Which of the following is false?

- A) The trip takes 75 minutes when the speed of the train is 100 km/h.
- B) The function f has no zero.
- C) The function f is decreasing.
- D) The speed of the train is 40 km/h when the trip takes 3 hours.

2. Consider the line ℓ given by the equation: $y = \frac{1}{3}x + 2$.

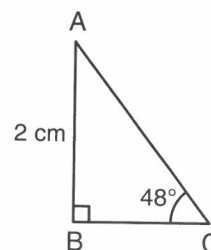
Which one of the following statements is false?

- A) The slope of the line is $\frac{1}{3}$.
- B) The y -intercept is 2.
- C) The x -intercept is 6.
- D) Line ℓ is perpendicular to the line given by the equation: $y = -3x + 7$.

3. Consider the right triangle ABC on the right.

What is, to the nearest tenth, the length of the hypotenuse AC?

- A) 1.5 cm
- B) 2.7 cm
- C) 3 cm
- D) 1.8 cm



4. The current population of a village is 16 000 inhabitants. Due to a hurricane destroying a large part of the village, the population decreases by 5% every 4 months.

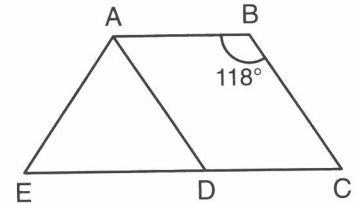
What will be the population of this village in 6 years? Round your answer to the nearest unit.

- A) 6 355 inhabitants C) 14 440 inhabitants
 B) 38 506 inhabitants D) 15 462 inhabitants

5. In the following figure, consider the parallelogram ABCD and the isosceles triangle EAD with main vertex A.

If angle ABC measures 118° , what is the measure of angle EAD?

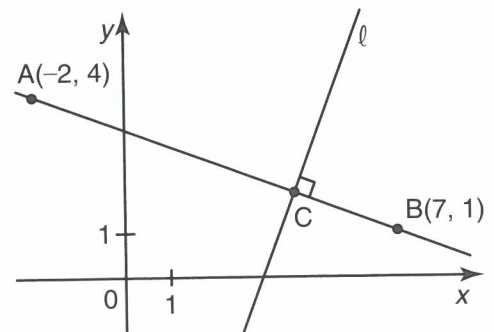
- A) 52° B) 31° C) 56° D) 118°



6. In the Cartesian plane on the right, line ℓ is perpendicular to line AB at point C. Point C divides segment AB in a 2:1 ratio from point A.

What is the x-intercept of line ℓ ?

- A) $-\frac{14}{3}$ C) 0
 B) $\frac{10}{3}$ D) -10



SECTION B

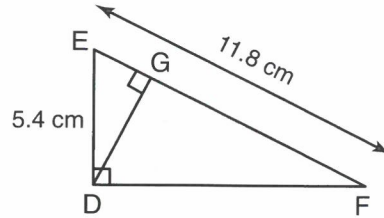
7. The ascent of a ball is described by a quadratic function. The given table of values associates, to the time elapsed since the beginning of the ascent, the height reached by the ball.

Time (sec)	0	2	4
Height (m)	0	3.2	12.8

How many seconds, after the beginning of the ascent, the ball will reach a height of 20m?

The ball will reach a height of 20 m after _____.

8. Consider the following right triangle EDF, given that D is a right angle. \overline{DG} is the altitude drawn from vertex D. We have: $m\overline{DE} = 5.4$ cm and $m\overline{EF} = 11.8$ cm.



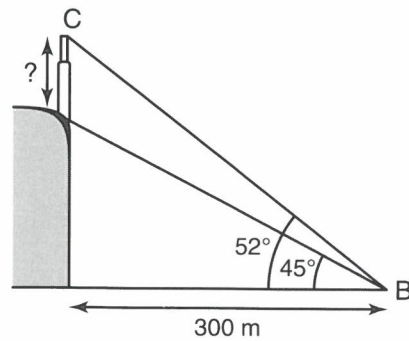
What is, rounded to the nearest tenth, the length of segment EG?

The length of segment EG is _____.

9. A passenger on a boat, located at point B, looks up to the top of a cliff, and to the top of a lighthouse located on the cliff, with angles of elevation of 45° and 52° respectively.

If the boat is 300 m from the base of the cliff, what is the height of the lighthouse? Round your answer to the nearest unit.

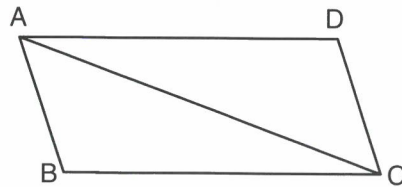
The height of the lighthouse is _____.



10. Consider the parallelogram ABCD and its diagonal AC. Justify the following statements that enable you to prove the property:

– The opposite sides of a parallelogram are congruent.

Consider triangles ABC and CDA.



STATEMENTS	JUSTIFICATIONS
1. $AB \parallel CD$ and $AD \parallel BC$	Opposite sides of a parallelogram are parallel.
2. $\overline{AC} \cong \overline{AC}$	Common side to triangles ABC and CDA.
3. $\angle BAC \cong \angle ACD$	Alternate-interior angles, formed by parallel lines AB and CD cut by transversal AC, are congruent.
4. $\angle DAC \cong \angle ACB$	_____
5. $\triangle ABC \cong \triangle CDA$	_____
6. $\overline{AB} \cong \overline{CD}$ and $\overline{AD} \cong \overline{BC}$	Corresponding sides of congruent triangles are congruent.

SECTION C

11. A MOTORCYCLE RIDE

Emile would like to rent a motorcycle to go tour the Gaspé region. There are two rental companies he can choose from. The rental cost includes a base price plus a daily rental fee.

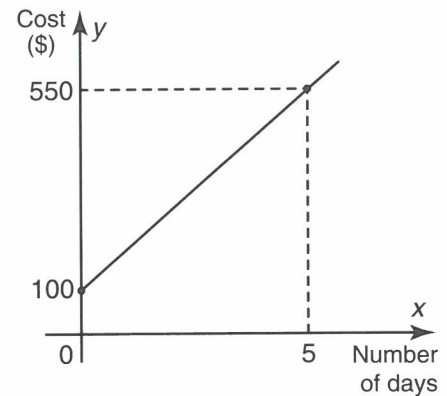
The following table and graph illustrate the total cost as a function of the number of rental days for the Rack and Vada rental companies.

Rack Company

Number of days	3	5	8	10
Cost (\$)	450	590	800	940

Help Emile make a decision as to which company he should choose to rent the motorcycle for his trip.

Vada Company



12. AN INVESTMENT

Eric buys a computer and pays \$1800. He knows that his computer will depreciate in value by 12% per year.

After 3 years, he decides to sell the computer and invest that money in a bank account at an interest rate of 3.6% compounded annually.

How much will his investment be worth 10 years after investing it in the bank? Round your answer to the nearest unit.

13. A HIKE IN THE MOUNTAINS

During a hike in the mountains, the air temperature (in °C) was recorded at different altitudes.

Using the Mayer line, estimate the air temperature at an altitude of 2500 m. Round your answer to the nearest tenth.

Altitude (in m)	Temperature (in °C)
400	16.8°
800	14.5°
1200	12.5°
1600	10.6°
2000	9.0°
2400	8.0°
2800	7.7°
3200	7.3°

15. A MUSIC SCHOOL

In a music school, the cost of a violin lesson is \$40/hour, and the cost of a piano lesson is \$35/hour.

Last Tuesday, the revenue generated by violin and piano lessons was \$2155. On that day, there were 5 more piano students than twice the number of violin students.

Determine the total number of students who had violin or piano lessons last Tuesday.

16. A SUMMER FESTIVAL

At a summer festival in the town of Green Rock, the organizers outline the perimeter where the festival will take place, as indicated in the figure on the right by the polygon OBCDE.

We have the following information:

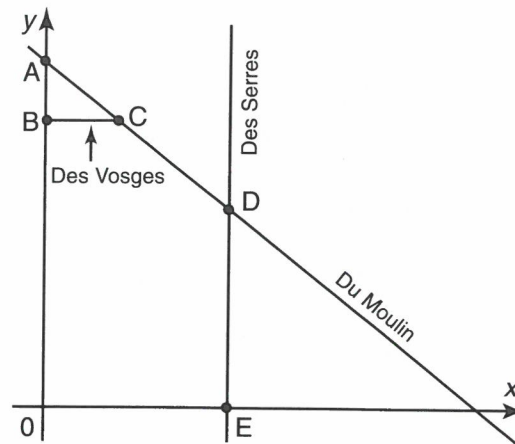
- The equation of Du Moulin street is:

$$y = -\frac{3}{4}x + 72.$$

- The equation of Des Serres street is:

$$x = 40.$$

- Point C divides segment AD in a 2:3 ratio from point A.
- Des Vosges street is parallel to the x -axis.



The dimensions are in metres.

The organizers must install a fence between points B and C.

What is the length, in metres, of this fence?

SECTION A

	A	B	C	D
1.	■	□	□	□
2.	□	□	■	□
3.	□	■	□	□
4.	■	□	□	□
5.	□	□	■	□
6.	□	■	□	□

SECTION B

- The ball will reach a height of 20 m after **5 seconds**.
- The length of segment EG is **2.5 cm**.
- The height of the lighthouse is **84 m**.
- Alternate-interior angles, formed by parallel lines AD and BC cut by transversal AC, are congruent.
– They have a congruent side between two corresponding congruent angles.
(ASA congruency case)

SECTION C

11. A MOTORCYCLE RIDE

► Choosing the variables

x : number of rental days

y : cost of the rental (\$)

► Rule for the Rack company

$$\text{Rate of change} = \frac{590 - 450}{5 - 3} = \$70/\text{day}$$

$$\text{Rule: } y = 70x + b$$

$$450 = 70(3) + b \quad (\text{The cost is } \$450 \text{ for 3 days})$$

$$240 = b$$

$$y = 70x + 240$$

► Rule for the Vada company

$$\text{Rate of change} = \frac{550 - 100}{5 - 0} = \$90/\text{day}$$

$$\text{Rule: } y = 90x + 100 \quad (\text{The initial cost is } \$100)$$

► Number of days for which the cost is the same

We solve the system:

$$\begin{cases} y = 70x + 240 \\ y = 90x + 100 \end{cases}$$

$$90x + 100 = 70x + 240 \quad (\text{We solve the system by comparison})$$

$$20x = 140$$

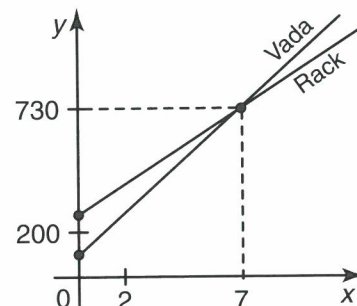
$$x = 7$$

$$\text{If } x = 7, y = 70(7) + 240 = \$730$$

► CONCLUSION

Emile will choose:

- Vada: if he rents the motorcycle for less than 7 days.
- Rack: if he rents the motorcycle for more than 7 days.
- Either company: if he rents for exactly 7 days.



12. AN INVESTMENT

► **Value of the computer after 3 years**

- Rule: $y = 1800(1 - 0.12)^t$
 $= 1800(0.88)^t$
- After 3 years: $y = 1800(0.88)^3$
 $= \$1226.65$

► **Value of the investment after 10 years**

- Rule: $y = 1226.65(1.036)^t$
- After 10 years: $y = 1226.65(1.036)^{10}$
 $= \$1747.10$

► **CONCLUSION**

10 years later, his investment will be worth **\$1747.10**.

13. A HIKE IN THE MOUNTAINS

	Altitude (in m)	Temperature (in °C)	
$\bar{x}_1 = 1000$	400	16.8°	$\bar{y}_1 = 13.6^\circ$
	800	14.5°	
	1200	12.5°	
	1600	10.6°	
$\bar{x}_2 = 2600$	2000	9.0°	$\bar{y}_2 = 8.0^\circ$
	2400	8.0°	
	2800	7.7°	
	3200	7.3°	

► **Equation of the Mayer line**

$P_1(1000, 13.6)$ $P_2(2600, 8.0)$

$$\text{Slope} = \frac{8.0 - 13.6}{2600 - 1000} = -0.0035^\circ/\text{m}$$

Mayer line: $y = -0.0035x + b$

$$13.6 = -0.0035(1000) + b$$

$$17.1 = b$$

$$y = -0.0035x + 17.1$$

(Point $P_1(1000, 13.6)$ is on the Mayer line)

► **Estimation of the temperature at an altitude of 2500 m**

$$y = -0.0035(2500) + 17.1 = 8.35^\circ$$

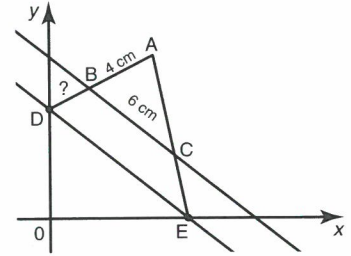
► **CONCLUSION**

Using the Mayer line, the temperature at an altitude of 2500 m is estimated, to the nearest tenth, to be **8.4°**.

14. THE LENGTH OF A SEGMENT

► Similarity of triangles ABC and ADE

- $\angle BAC \cong \angle DAC$ Common angle to triangles ABC and ADE
- $\angle ABC \cong \angle ADE$ Corresponding angles formed by parallel lines BC and DE, and the transversal line AB.
- $\triangle BAC \sim \triangle DAC$ They have two congruent angles (AA similarity case)



► Coordinates of points D and E

- $3x + 4(0) - 24 = 0$ (Point E is located on the x-axis)
- $3x - 24 = 0$
- $x = 8$

We have: E(8, 0)

- $3(0) + 4y - 24 = 0$ (Point D is located on the y-axis)
- $4y - 24 = 0$
- $y = 6$

We have: D(0, 6)

► Length of segment DE

$$\begin{aligned} m \overline{DE} &= \sqrt{(0 - 8)^2 + (6 - 0)^2} \\ &= \sqrt{64 + 36} \\ &= 10 \text{ cm} \end{aligned}$$

► Length of segment BD

Let $x = m \overline{BD}$

We get the proportion:

$$\begin{aligned} \frac{4}{4 + x} &= \frac{6}{10} && \text{(Triangles ABC and ADE are similar)} \\ 24 + 6x &= 40 \\ 6x &= 16 \\ x &= 2.67 \text{ cm} \end{aligned}$$

► Conclusion

The length of segment BD, to the nearest tenth, is **2.7 cm**.

15. A MUSIC SCHOOL

► **Identify the variables**

x : number of students who had a violin lesson
 y : number of students who had a piano lesson

► **System of equations**

$$\begin{cases} 40x + 35y = 2155 \\ y = 2x + 5 \end{cases}$$

► **Solving the system**

$$40x + 35(2x + 5) = 2155 \quad (\text{We solve the system by substitution})$$

$$40x + 70x + 175 = 2155$$

$$110x = 1980$$

$$x = 18$$

$$y = 2(18) + 5 = 41$$

18 students had a violin lesson, and 41 students had a piano lesson.

► **CONCLUSION**

Last Tuesday, the total number of students who had a violin or a piano lesson was **59**.

16. A SUMMER FESTIVAL

► **Coordinates of point A**

$$y = -\frac{3}{4}x + 72$$

$$y = -\frac{3}{4}(0) + 72 \quad (\text{Point A is located on the } y\text{-axis})$$

$$y = 72$$

We have: A(0, 72)

► **Coordinates of point D**

$$y = -\frac{3}{4}x + 72$$

$$y = -\frac{3}{4}(40) + 72 \quad (\text{Point D is located on line } x = 40)$$

$$y = 42$$

We have: D(40, 42)

► **x-coordinate of point C**

$$x_C = x_A + \frac{2}{5}(x_D - x_A)$$

$$= 0 + \frac{2}{5}(40 - 0)$$

$$= 16$$

► **CONCLUSION**

The length of the fence to be installed by the organizers is **16 m**.

