

Multiple Choice

Academic Program

Release Items



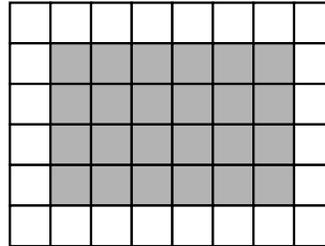
Education
Quality and
Accountability
Office

Directions to Students About Answering Multiple-Choice Questions

1. For this part of the assessment, make sure that you have the following materials along with *Booklet 1*:
 - a Student Answer Sheet
 - an HB pencil or a pen
 - a ruler and a protractor
 - a scientific calculator or graphing calculator
 - some paper for rough work
2. Be sure to read the problem and all four answer choices for each question carefully. When you choose an answer, fill in the appropriate circle on your answer sheet.
3. Always choose the best answer. Mark only one answer for each question.
4. There are 24 questions in *Booklet 1*. Try to answer all of them. Do not spend too much time on any one question.
5. Figures in this section are not drawn to scale.
6. Now do the following sample question. Fill in your choice below the sample question.

Sample Question

1. Find the area of the shaded region of the rectangle below.



 1 square unit

- A 16 square units
- B 24 square units
- C 30 square units
- D 36 square units

1. A B C D

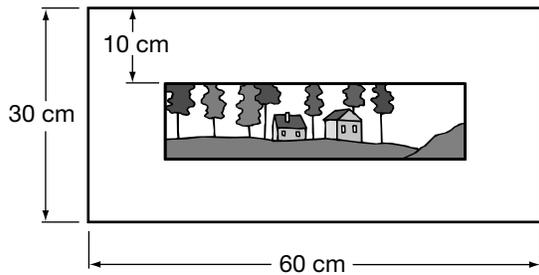
You should have filled in circle B. If you did not mark the circle that goes with B, put an X through the incorrect answer and fill in the correct answer.

7. You will have **30 min** to do the 24 multiple-choice questions.



8. When you see the  sign, you have completed *Booklet 1*. Check your answers. Then wait quietly for directions from your teacher.

1. The frame of a picture measures 60 cm by 30 cm. The border around the picture is 10 cm wide.



What are the dimensions of the **picture**?

- A 40 cm × 10 cm
- B 50 cm × 20 cm
- C 50 cm × 30 cm
- D 60 cm × 30 cm

2. Tim shows the steps he took in simplifying the following algebraic expression:

$$\frac{(a^2)^3}{a^2 \times a^3}$$

$$= \frac{a^5}{a^2 \times a^3} \quad \text{Step 1}$$

$$= \frac{a^5}{a^{2+3}} \quad \text{Step 2}$$

$$= \frac{a^5}{a^5} \quad \text{Step 3}$$

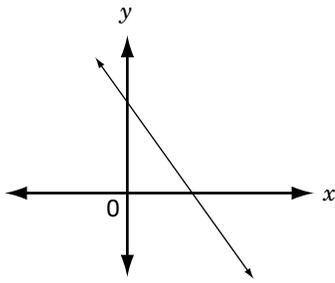
$$= 1 \quad \text{Step 4}$$

In which step did Tim make an **error**?

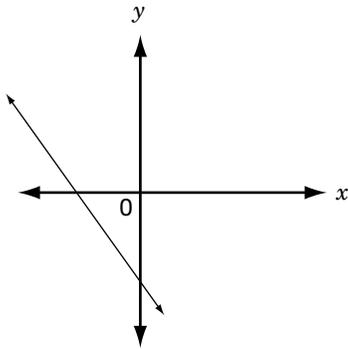
- F Step 1
- G Step 2
- H Step 3
- J Step 4

3. Which graph is the best match to a sketch of $y = -3x - 4$?

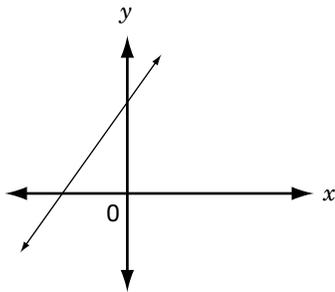
A



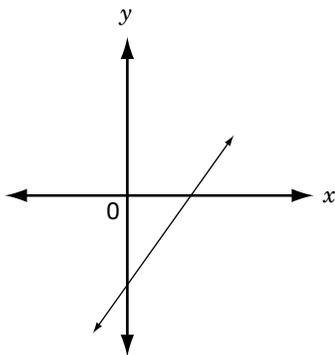
B



C



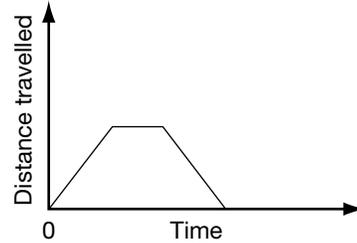
D



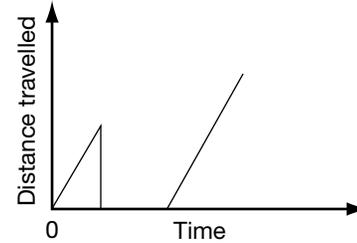
4. Nicole rides her bike to school in the morning. She stops at a store for about 5 min when she is halfway to school. Which graph below best describes this situation?



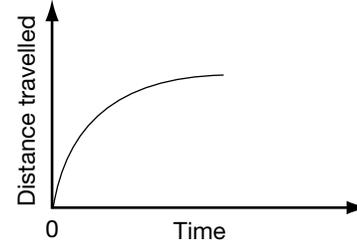
F



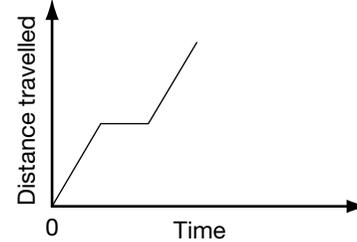
G



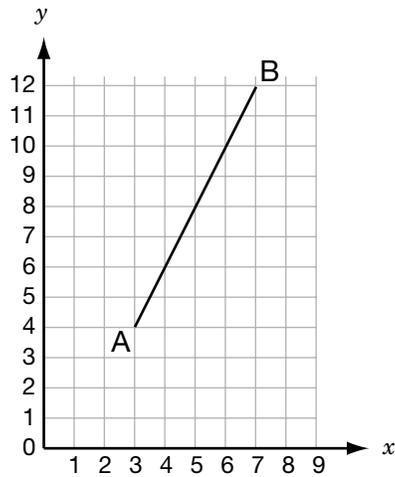
H



J

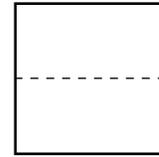


5. If A is (3, 4) and B is (7, 12), which point is on the line segment AB?

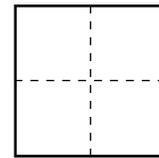


- A** (3, 5)
B (4, 8)
C (5, 9)
D (6, 10)

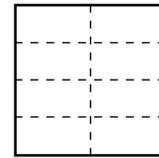
6. Sylvie folds a large piece of paper in half. The fold divides the paper into two equal parts. She folds it in half again. When she unfolds it, the folds divide the paper into four equal parts.



1 fold, 2 parts



2 folds, 4 parts



3 folds, 8 parts

She continues to fold and unfold the paper until the folds divide the paper into 64 equal parts.

How many times altogether has Sylvie folded the paper?

- F** 5 times
G 6 times
H 7 times
J 8 times

7. Which table of values shows a non-linear relationship between x and y ?

A

x	y
1	0
2	7
3	26
4	63

B

x	y
1	5
2	9
3	13
4	17

C

x	y
1	-7
2	-9
3	-11
4	-13

D

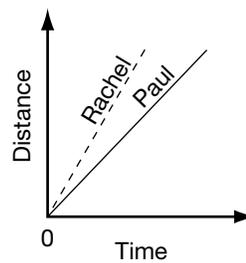
x	y
1	-5
2	7
3	19
4	31

8. Paul and Rachel are riding their bikes from their school to the park. They both leave at the same time and from the same location. However, Rachel pedals faster and gets to the park ahead of Paul.

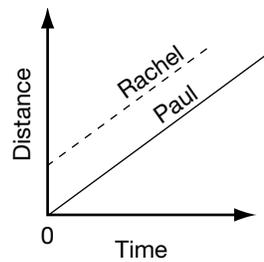


Which distance-time graph best illustrates their bike trips?

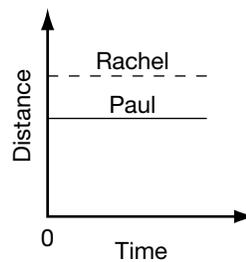
F



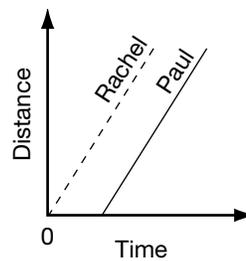
G



H



J



9. Juan shows the steps he took in rearranging a formula:

Given $P = 2(l + w)$

Step 1 $P = 2l + 2w$

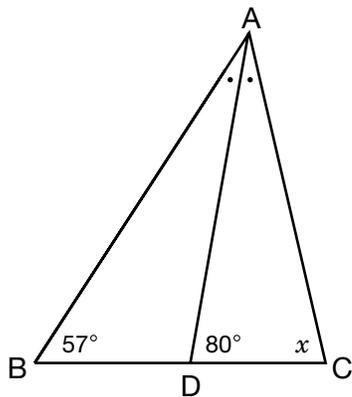
Step 2 $P + 2l = 2w$

Step 3 $\frac{P + 2l}{2} = w$

Step 4 $\frac{P}{2} + l = w$

In which step did Juan make an error?

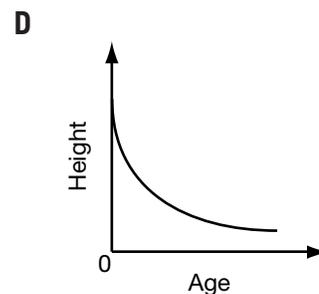
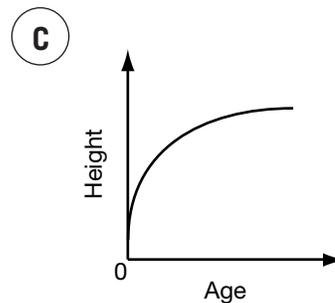
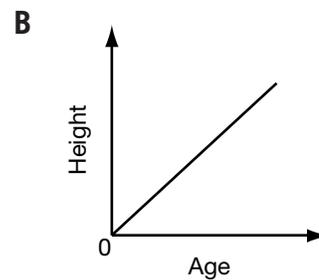
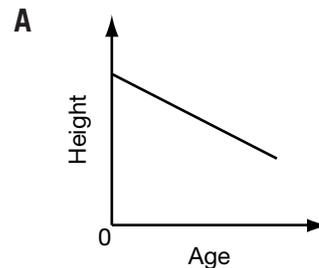
- A Step 1
B Step 2
 C Step 3
 D Step 4
10. AD is the angle bisector of $\angle BAC$.
 $\angle ABD = 57^\circ$ and $\angle ADC = 80^\circ$.
 What is the value of angle x ?



- F 50°
 G 57°
 H 70°
J 77°

11. Nicole measures the heights of children at a child care centre and finds that the height of a child increases non-linearly as the child's age increases.

Which graph represents Nicole's findings?



12. What is the equation of a line passing through the points (2, 5) and (4, 11)?

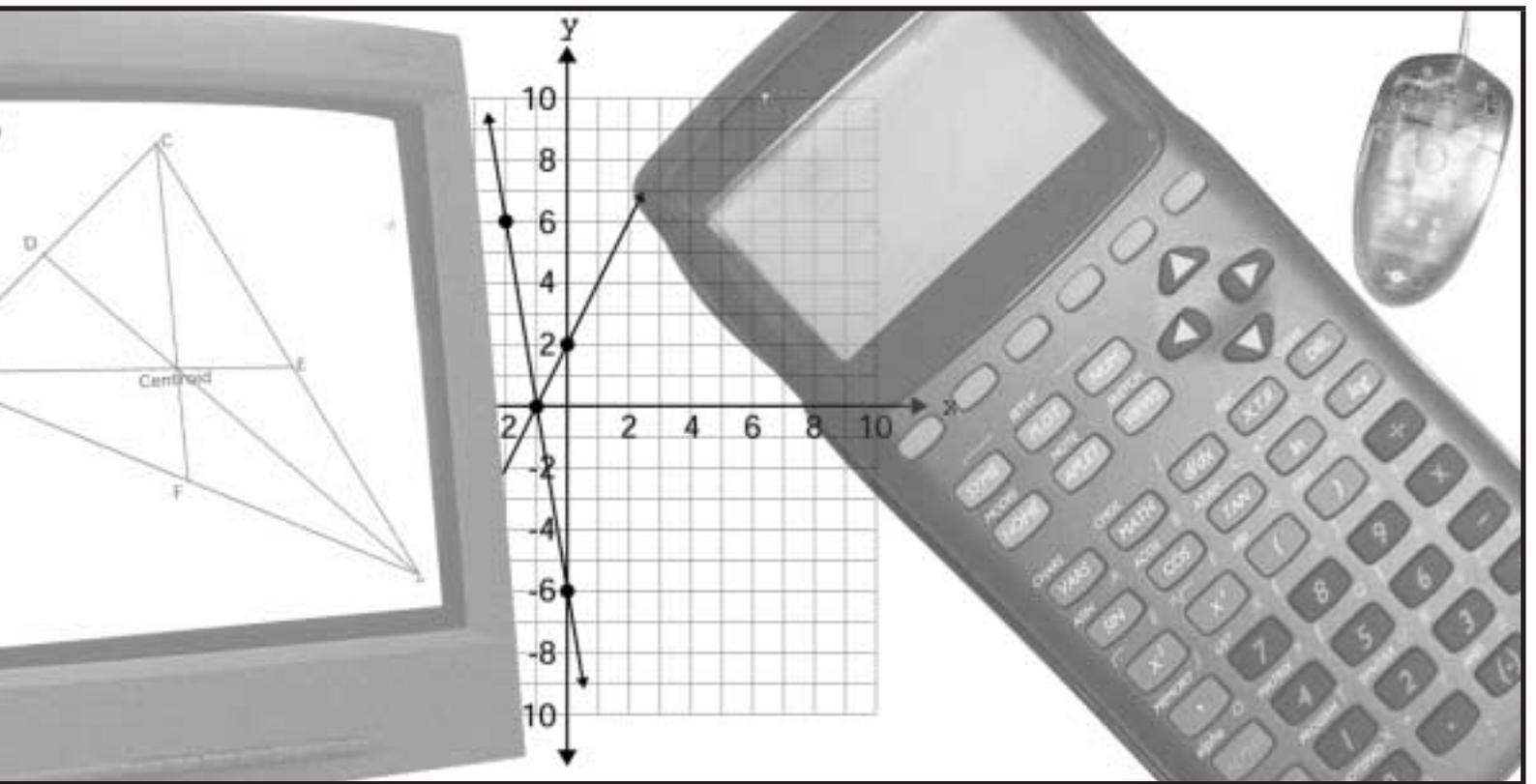
F $y = x - 3$

G $y = 2x - 1$

H $y = 3x - 1$

J $y = 4x - 3$





Short Answer

Academic Program

Release Items



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Directions to Students about Answering Short Answer Items

1. For this part of the assessment, make sure you have the following items along with *Booklet 3*:
 - a pencil and an eraser or a pen
 - a scientific or graphing calculator
 - a ruler and a protractor
2. Do all of your work (even rough work) in *Booklet 3*.
3. You will have 30 min to do these 10 items. That means you have about 3 min for each one. Give yourself time to answer all of the questions.
4. Figures in this section are not drawn to scale.
5. These questions are designed to get you to think deeply about the mathematics you know but they do not require you to write a great deal. Be sure to watch for the terms listed in the Key Words and Phrases in Instructions and do just what the prompt asks you to do.

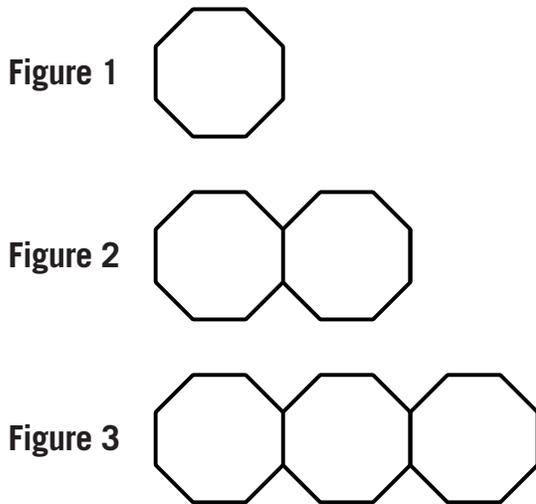
For example, the question might ask you to “**Explain** your answer.” The Key Words and Phrases in Instructions sheet says, “**Explain** means to use words and symbols to make your solutions clear and understandable.” As soon as you can explain a mathematical reason for the answer, do so. You do not need to provide lots of calculations to illustrate your point.
6. In short answer questions, you do not have to provide lots of examples to illustrate your answer. Write a short answer.
7. You have **30 min** to work.
8. When you see the  sign, you have completed *Booklet 3*. Check your answers. Then wait quietly for directions from your teacher.

1. The following octagons are constructed with toothpicks.

Paul is going to extend the pattern.

Determine how many toothpicks Paul would need to create a figure with 21 octagons.

Show your work.



n	t
1	8
2	15
3	22

let n be number of octagons
and t be number of toothpicks

$$t = 1 + 7n$$

with 21 octagons.

$$t = 1 + 7(21)$$

$$= 148$$

148 toothpicks is needed

Coding Guide

Academic Program — Short Answer Questions

b — blank: nothing at all is written for the solution

u — unrelated or unengaged: the student has written “I don’t know” or a question mark; the student has simply rewritten the question

exactly as posed; the student has offered unrelated comments or drawn pictures; the student has not engaged in the problem solution

Erasures — Do not code erased work.

Question Number	Codes			Category and Strand
	0	1	2	
1	<ul style="list-style-type: none"> answer incorrect, work inappropriate answer incorrect, work not shown 	<ul style="list-style-type: none"> answer correct, work not shown answer incorrect, work shown, one error in logic (e.g., does not include the overlapping toothpick) 	<ul style="list-style-type: none"> answer correct (i.e., 148), work appropriate (e.g., table, equation or graph) 	PS-R

Question	Code	Rationale
1	2	Appropriate work leads to a correct answer of 148 toothpicks.

2. At Store A, a computer is regularly priced at \$1299.00. It is on sale for 20% off the regular price.

SALE
20% off

At Store B, the same computer is regularly priced at \$1549.00. It is on sale for 30% off the regular price.

SALE
30% off

Write calculations to **explain** why you should buy the computer at Store A.

$$\begin{array}{l} \text{STORE A} = 1299(0.2) \\ = 259.8 \end{array} \quad \begin{array}{l} \text{STORE B} = 1549(0.3) \\ = 464.7 \end{array}$$

$$\begin{array}{l} \text{COST} = 1299 - 259.8 \\ = 1039.2 \end{array}$$

$$\begin{array}{l} \text{COST} = 1549 - 464.7 \\ = 1084.3 \end{array}$$

DIFFERENCE

$$\begin{array}{l} = 1039.2 - 1084.3 \\ = -45.1 \end{array}$$

∴ THE COMPUTER AT STORE A IS \$45.10 CHEAPER THAN THE ONE AT STORE B.

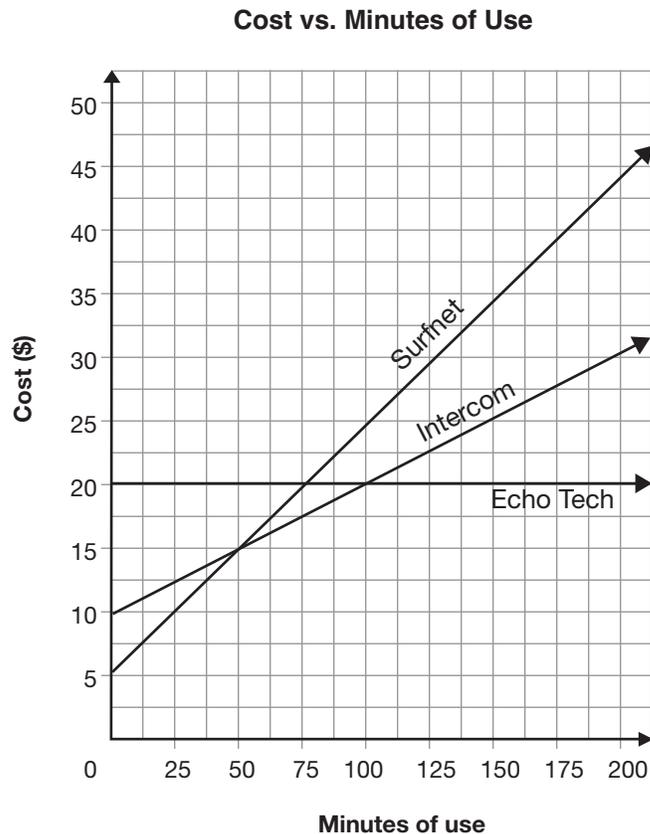


Question Number	Codes			Category and Strand
	0	1	2	
2	<ul style="list-style-type: none"> communicates thinking process unclearly (e.g., “because store A is cheaper”) 	<ul style="list-style-type: none"> communicates thinking process somewhat clearly (e.g., $1299 - 20\% = 1299 - 64.95 = 1234.05, \dots$) Note: the correctness of the thinking processes used should not be considered. 	<ul style="list-style-type: none"> communicates thinking process clearly Note: the correctness of the thinking processes used should not be considered. 	CM-N

Question	Code	Rationale
2	2	The calculations and writing provided in the student work clearly demonstrate the thinking process.

3. The graph shows the relationship between total cost and minutes of use for three Internet companies.

Tenisha wants to sign up with one of the companies and she wants to pay as little as possible. Her choice will depend on how many minutes of use she has.



Determine which company Tenisha should use.

Include details about minutes of use in your explanation.

- Surfnet would be best if you only use less than 50 mins of the internet
- Intercom would be best if you use 50 to 100 mins of the internet
- Echo Tech would be best if you use more than 100 mins of internet

Question Number	Codes			Category and Strand
	0	1	2	
3	<ul style="list-style-type: none"> incorrect conclusion, illogical or no reasoning 	<ul style="list-style-type: none"> correct conclusion supported by partially logical reasoning 	<ul style="list-style-type: none"> correct conclusion (e.g., “If she plans to use 0 – 50 min, she should use Surfnet. If she plans to use from 50 to 100 min, she should use Intercom. If she plans to use more than 100 min, she should use Echo Tech.”) supported by logical reasoning (e.g., “On the graph the companies have the cheapest rates in those ranges.”) 	PS-G

Question	Code	Rationale
3	2	A correct conclusion is stated and supported by logical reasoning.

4. **Expand** and **simplify** the following expression:

$$2(x^2 - 2x + 1) - x(x - 3)$$

$$= 2x^2 - 4x + 2 - x^2 + 3x$$

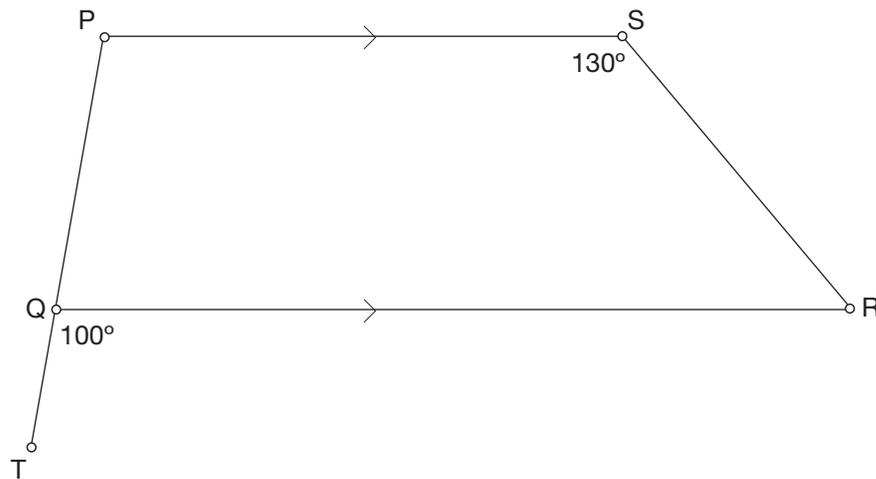
$$= x^2 - x + 2$$

Question Number	Codes			Category and Strand
	0	1	2	
4	<ul style="list-style-type: none"> • makes more than two errors 	<ul style="list-style-type: none"> • makes one or two errors in either expanding or simplifying (e.g., writes the last term as $-3x$ vs. $+3x$) or • expands correctly but does not simplify 	<ul style="list-style-type: none"> • expands and simplifies correctly (i.e., $x^2 - x + 2$); order of the terms does not matter 	KU-N

Question	Code	Rationale
4	2	The student work shows correct processes of expanding and simplifying the algebraic expression to arrive at $x^2 - x + 2$.

5. In quadrilateral PQRS, segment PS is parallel to segment QR. Some of the angles are known.

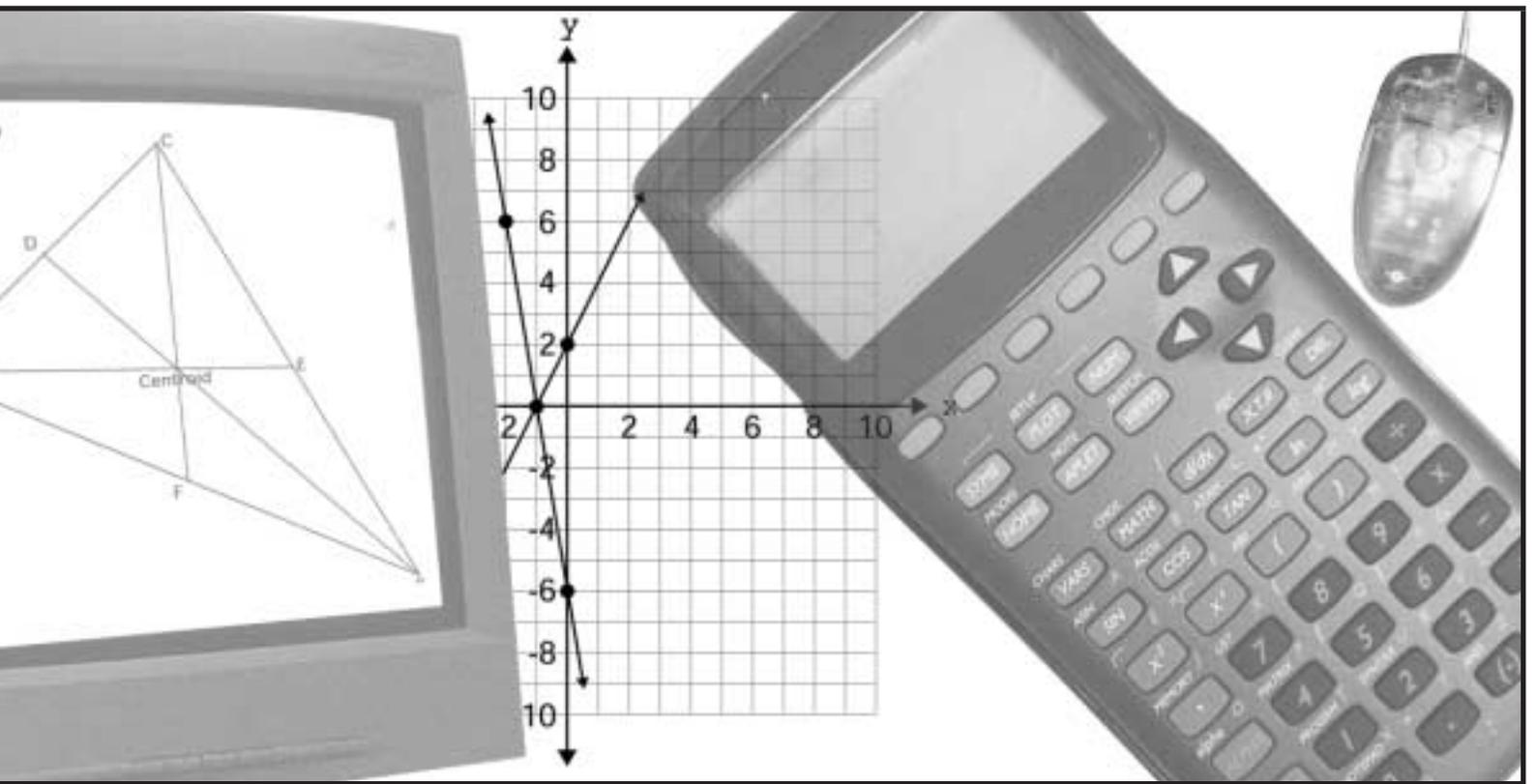
Explain how to use geometric properties to determine the measures of $\angle P$ and $\angle R$.



Angle Measure	Explanation
$\angle P = 100^\circ$	By using the "F" pattern of corresponding angles you know that $\angle P$ is equal to $\angle Q$. So therefore $\angle P$ must be 100°
$\angle R = 50^\circ$	All the angles in a quadrilateral add up to 360° . $\therefore 360 - 130 - 100 - 80 = R$, therefore $\angle R$ must equal 50°

Question Number	Codes			Category and Strand
	0	1	2	
5	<ul style="list-style-type: none"> incorrect angle measures, unclear and incomplete or missing explanations 	<ul style="list-style-type: none"> correct angle measure and clear and complete explanation for one of the angles, the other angle measure incorrect or missing, with unclear and incomplete or missing explanation or both angle measures correct, explanations partly clear and incomplete 	<ul style="list-style-type: none"> correct angle measures (i.e., 100°, 50°). Clear and complete explanation for both (e.g., "PS and QR are parallel, so $\angle P$ and $\angle TQR$ are equal corresponding angles" and "PS and QR are parallel, so $\angle S$ and $\angle R$ are supplementary.") 	CM-M

Question	Code	Rationale
5	2	The values of $\angle P$ and $\angle R$ are stated correctly and are supported by clear and complete explanations.



Tasks

Academic Program

Release Items



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Directions to Students about Answering Tasks

1. For this part of the assessment, make sure you have the following items along with *Booklet 2*:
 - a pencil and an eraser or a pen
 - a scientific or graphing calculator
 - a ruler and a protractor
2. Do all of your work (even your rough work) in *Booklet 2*.
3. You will work in the booklet on two different days. Each day you will have 40 min to do 3 tasks. Allow about 15 min for each of the first two tasks and about 10 min for the third. Give yourself time to answer all of the questions.
4. Figures in this section are not drawn to scale.
5. The tasks are designed to allow you an opportunity to show what you know and what you can do. Provide as much information as you can to show your understanding. Your teacher may be marking some of your work. In addition, someone who does not know your work will mark all of it, including what your teacher has marked. So, you must provide clear, well-organized answers to illustrate your complete understanding and ability to communicate in mathematics.
6. Make sure you follow directions from the Key Words and Phrases in Instructions sheet. It is provided for you so you will know the kind of question that is being asked.

For example, the question might ask you to “**Show your work.**” Read the Key Words and Phrases in Instructions sheet. It says to record all calculations. If you use your calculator, you need to show what calculations you do. If you sketch a graph in the process of getting to your solution, show the sketch and label it. Use proper and correct mathematical conventions when you present your work.
7. When using a calculator, write down the numbers and operations that you carried out on the calculator.

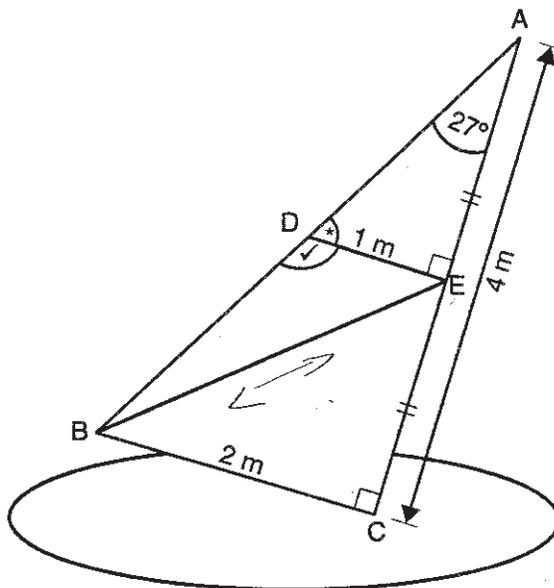
For example: Find the area of a circle with a diameter of 7 cm.

You need to write $A = \pi(3.5)^2$ as well as the answer you got on your calculator.
8. There are always many different ways to solve a problem. Use your broad range of mathematical knowledge to present a complete and creative solution to each question.
9. You have **40 min** to work.
10. When you see the  sign, you have completed the work for the day. Check your answers. Then wait quietly for directions from your teacher.

Task 1: The Sailboard

Jonathan likes to windsurf. He wants a three-colour sail for his sailboard.

- a) Complete the chart below by
- **determining** the measures of $\angle ADE$ and $\angle BDE$
 - **giving reasons for your answers.**



$$\begin{aligned} \angle ADE & 180^\circ = 27^\circ + 90^\circ + x \\ & x = 63^\circ \\ \angle BDE & 180^\circ = 63^\circ + x \\ & x = 117^\circ \end{aligned}$$

Angle	Measure	Reasons
$\angle ADE$ (+)	63°	- angles of a triangle always add up to 180° - given 2 angles, so an equation can be used to solve
$\angle BDE$ (✓)	117°	- supplementary angles add up to 180° - given one angle, so supplement can be found

- b) Jonathan wants coloured trim along the segment BE of the sail.

Calculate the length of trim he will need.

Show your work.

$$\begin{aligned} \overline{CE} + \overline{EA} &= 4\text{m} \\ \overline{CE} &= \overline{EA} \\ 2x &= 4 \\ x &= 2\text{ metres} \end{aligned}$$

$$\begin{aligned} a^2 + b^2 &= c^2 \\ (CB)^2 + (CE)^2 &= (BE)^2 \\ 2^2 + 2^2 &= c^2 \\ 4 + 4 &= c^2 \\ \sqrt{8} &= \sqrt{c^2} \\ c &= 2.828427125 \\ c &\approx 2.83\text{ m} \end{aligned}$$

Hint:

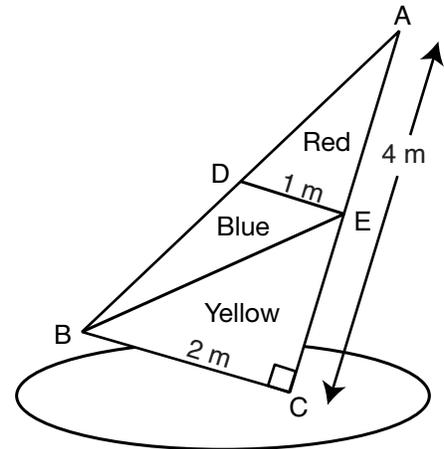
BC = 2 m
CA = 4 m
CE = EA

\therefore The trim will be 2.83m.

c) Jonathan wants a sail with three colours.

The table below shows the colours of material available and the cost.

Complete the table.



Colour	Cost of material (\$/m ²)	Area of section (m ²)	Cost of section (\$)
Yellow	5.10	$A = \frac{b \times h}{2} = \frac{2 \times 2}{2} = 2 \text{ m}^2$	10.20
Blue	4.40	1 m ²	$4.4 \times 1 = \$4.40$
Red	4.50	$A = \frac{b \times h}{2} = \frac{2 \times 1}{2} = 1 \text{ m}^2$	$4.5 \times 1 = \$4.50$
Total			$\$10.2 + 4.4 + 4.5 = \19.10

d) Jonathan decides to make the three sections of the sail, using only **two** colours.

Identify and record on the diagram which colour should be used for each section of the sail so that the total cost is as **low** as possible.

Give reasons for your answer.

$$A_{\text{Blue}} = 1 + 2 = 3 \text{ m}^2$$

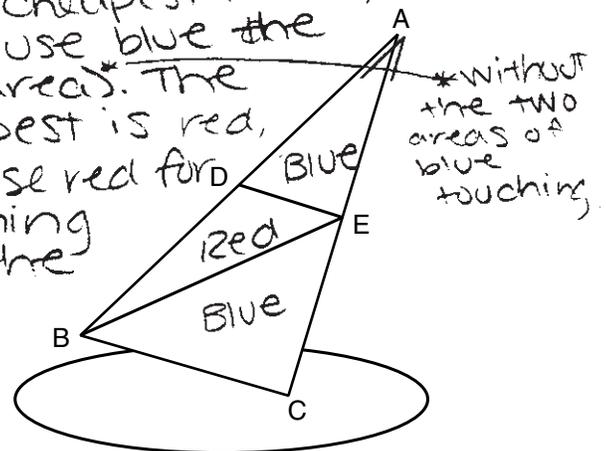
$$\text{Cost: } 3 \times 4.40 = \$13.20$$

$$A_{\text{Red}} = 1 \text{ m}^2$$

$$\text{Cost: } 1 \times 4.50 = \$4.50$$

$$\text{Total Cost: } \$4.50 + \$13.20 = \$17.70$$

Blue is the cheapest colour, so he will use blue the most (in area). The next cheapest is red, so he will use red for the remaining area of the sail.



Extended Response Coding Guide Academic Program

Task #1 – The Sailboard

b — blank: nothing at all is written for the solution

u — unrelated or unengaged: the student has written “I don’t know” or a question mark; the student has simply rewritten the question exactly as posed; the student has offered unrelated comments or drawn pictures; the student has not engaged in the problem solution

Erasures — Do not code erased work.

Category Definitions				
KU	The knowledge of concepts and the ability to carry out procedures (e.g., operations, algorithms) to solve problems.			
AP	The selection of concepts, procedures, algorithms, tools and prior knowledge and fitting them into the context and the information in the problem.			
PS	The processes of using reasoning to pull together information in a problem, manipulating and transforming the information in a problem in order to see a solution, and reflecting on the solution to see restrictions and judge how well the solution answers the problem.			
Cat	Parts/Strand	Codes	Descriptions	
KU	a)	M	1	<ul style="list-style-type: none"> both answers incorrect
			2	<ul style="list-style-type: none"> one answer correct with no reasons given, the other incorrect
			3	<ul style="list-style-type: none"> both answers correct, no reasons given
			4	<ul style="list-style-type: none"> one answer correct with appropriate reasons given, the other incorrect
			5	<ul style="list-style-type: none"> both answers correct with appropriate reasons given
AP	b)	N	1	<ul style="list-style-type: none"> incorrect answer, no apparent strategy
			2	<ul style="list-style-type: none"> incorrect answer, inappropriate strategy
			3	<ul style="list-style-type: none"> appropriate strategy (e.g., Pythagorean theorem, line lengths) with incorrect answer due to major error in fitting to the context (e.g., uses 4 m for CA)
			4	<ul style="list-style-type: none"> appropriate strategy (e.g., Pythagorean theorem, line lengths) leading to correct answer with little or no work shown
			5	<ul style="list-style-type: none"> appropriate strategy (e.g., Pythagorean theorem, line lengths) leading to correct answer (e.g., $\cong 2.8$) with all work shown <p>Note: ignore minor calculation error(s)</p>
KU	c)	N	1	<ul style="list-style-type: none"> all entries in table are incorrect
			2	<ul style="list-style-type: none"> 1 correct entry in table [note: total is correct if consistent with previous error(s)]
			3	<ul style="list-style-type: none"> 2 correct entries in table [note: total is correct if consistent with previous error(s)]
			4	<ul style="list-style-type: none"> 3 correct entries in table [note: total is correct if consistent with previous error(s)]
			5	<ul style="list-style-type: none"> 4 of 5 correct entries in table (note: total is correct if consistent with previous error)
			6	<ul style="list-style-type: none"> all entries in table correct (i.e., 2, 1, 4.40, 4.50, 19.10)
PS	d)	N	1	<ul style="list-style-type: none"> incorrect solution with illogical or no reasoning
			2	<ul style="list-style-type: none"> incorrect solution with work that shows partially logical reasoning
			3	<ul style="list-style-type: none"> correct solution with illogical or no reasoning
			4	<ul style="list-style-type: none"> correct solution (e.g., $\triangle ADE$ and $\triangle EBC$ are labelled “blue”, $\triangle DBE$ is labelled “red”, total cost is \$17.70) with work that shows partially logical reasoning (e.g., does not give reasons for colours for all three triangles)
			5	<ul style="list-style-type: none"> calculation error(s) in solution with work that shows logical reasoning that supports the answer
			6	<ul style="list-style-type: none"> correct solution (e.g., $\triangle ADE$ and $\triangle EBC$ are labelled “blue”, $\triangle DBE$ is labelled “red”, total cost is \$17.70) with work that shows logical reasoning that supports the answer (e.g., work shows that $\triangle EBC$ is blue since its area is the largest and blue is the cheapest colour; the other 2 triangles can be any combination of blue and red, since they are equal in area and red is the next cheapest colour) <p>Note: Other solutions are possible and total cost is not required.</p>
CM	Presentation of thinking: The consistency, quality and language of solutions and explanations of reasoning		1	<ul style="list-style-type: none"> communication is unclear, incomplete and does not reveal the thinking process
	d)	(th)	2	<ul style="list-style-type: none"> communication is somewhat clear and complete and reveals some of the thinking process
			3	<ul style="list-style-type: none"> communication is mostly clear and complete and reveals most of the thinking process
			4	<ul style="list-style-type: none"> communication is clear and complete and reveals the thinking process
			Mathematical conventions: The consistency, quality, selection and integration of symbols, vocabulary and mathematical forms used	
CM	all	(co)	1	<ul style="list-style-type: none"> mathematical conventions are rarely used properly
			2	<ul style="list-style-type: none"> mathematical conventions are sometimes used properly
			3	<ul style="list-style-type: none"> mathematical conventions are mostly used properly
			4	<ul style="list-style-type: none"> mathematical conventions [e.g., proper units (i.e., \$, °), complete equations] are used properly

Rationale for Coding of Student Work Academic Items

Task #1 – The Sailboard

Category	Portion of Task	Code	Rationale
KU	a)	5	Angle measures are stated correctly (i.e., 63° and 117°) with appropriate reasons for each value.
AP	b)	5	The student uses the Pythagorean theorem to determine the length of trim ≈ 2.83 m and provides supporting work.
KU	c)	6	All entries in the table are correct (i.e., 2, 1, 4.40, 4.50, 19.10).
PS	d)	6	Identifies blue and red as the two colours that should cover the sail to produce the lowest possible cost. The selection of colours is supported with the reasoning that the cheapest ($\$/\text{m}^2$) colour should be used for the portion of the sail with the largest area.
CM	d)	4	Communication is clear and complete and reveals the thinking process in part d).
CM	all	4	Mathematical conventions are used properly throughout the task.

Task 2: Stretch Signs Basketball Contract

When Stretch Gordon signed a contract to play basketball for the Toronto Raptors, he received a **one-time \$250 000 signing bonus**. His contract said that he would also receive **\$100 000 for each game he plays**.

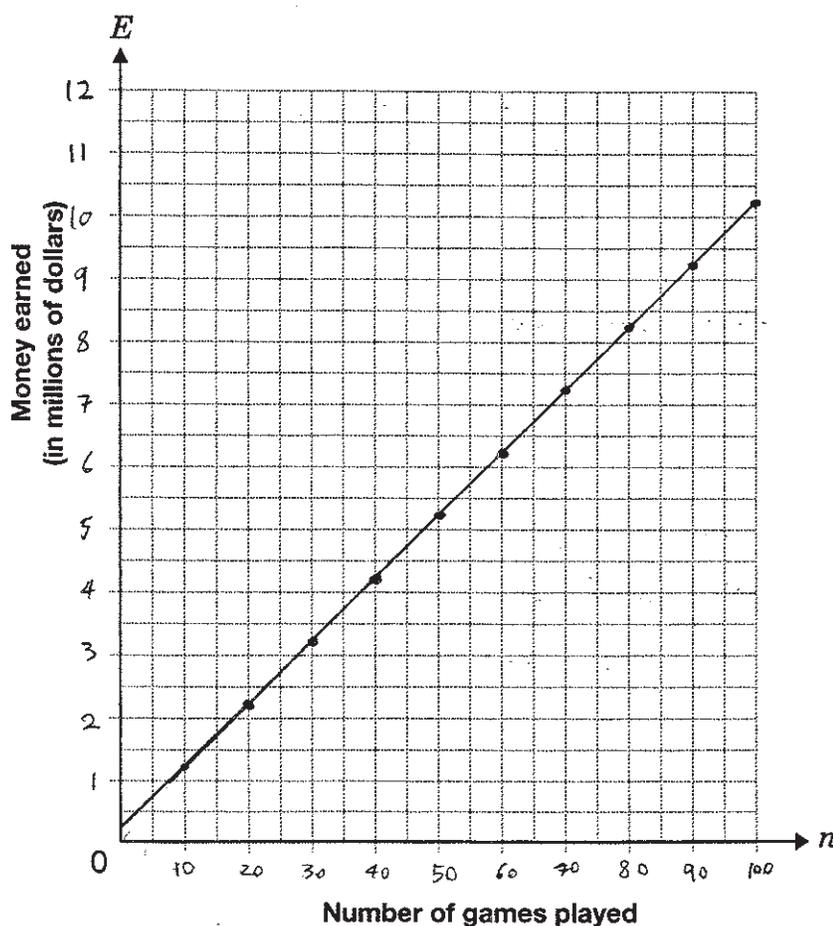
The Raptors are scheduled to play **85 games** this season.

- a) Create a table of values that will show some of the possible amounts Stretch might earn throughout the first **season**. Number of games played is represented by n and money earned by E .

Number of games played, n	Money earned, E (in dollars)
10	\$1250 000
20	\$2250 000
30	\$3250 000
40	\$4250 000
50	\$5250 000

$$E = 100\,000n + 250\,000$$

- b) **Graph** the information to show his earnings for the **season**. Use a suitable scale. Change the money values in your table to millions of dollars before starting.



- c) i) **Write an equation** relating Stretch's earnings to the number of games he plays.

$$E = 100\,000(n) + 250\,000$$

- ii) **Define** your variables, including units.

$$E = 100\,000(n) + 250\,000$$

↑ ↑ ↑ ↑
 Total Amount of # of The one-time
 Amount of Earning per games signing bonus
 Earning game played (y-intercept)
 (the y) (slope) (the x)

- iii) **Explain** what **the numbers** in your equation represent for Stretch.

For Stretch, 100 000 represents the amount of earnings per game, and 250 000 represents the one-time signing bonus, which is sort of like a fixed cost that he gets when he first signs up, no matter how many games he played.

- d) How much money will Stretch make if he plays 44 games this season?

Show your work.

$$E = 100\,000(44) + 250\,000$$

$$E = 4\,400\,000 + 250\,000$$

$$E = 4\,650\,000$$

∴ Stretch will make \$4.65 million dollars if he plays 44 games this season.



- e) Stretch's twin brother, Rory, has been offered a different contract. The following equation defines the offer:

$$E = 95\,000n + 450\,000$$

E represents Rory's total earnings in dollars and n represents the number of games Rory plays.

Is this a better offer than Stretch's? **Give reasons for your answer** by comparing the two offers, reporting mathematical details about the comparison.

# of games	Stretch ($E=100\,000n+250\,000$)	Rory ($E=95\,000n+450\,000$)	who earns more
39	$100\,000(39)+250\,000=4\,150\,000$	$95\,000(39)+450\,000=4\,155\,000$	Rory
40	$100\,000(40)+250\,000=4\,250\,000$	$95\,000(40)+450\,000=4\,250\,000$	Equal
41	$100\,000(41)+250\,000=4\,350\,000$	$95\,000(41)+450\,000=4\,345\,000$	Stretch
	etc	etc	
	etc	etc	
	etc	etc	

Note:
85 games are scheduled but we don't know how many Rory or Stretch will actually play.

As you can see on this table, Rory's offer is better if they play less than 40 games, and Stretch's offer is better if they play more than 40 games (when they play 40 games, both offers are equally good).

--- You can also use graphing calculator ---

- 1) Go to $Y=$.
- 2) Program stretch's equation at $Y_1=$ & Rory's equation at $Y_2=$.
- 3) Go to **Window** and change: $X_{min}=0$, $X_{max}=90$, $X_{scl}=10$, $Y_{min}=0$, $Y_{max}=11\,000\,000$, $Y_{scl}=1\,000\,000$, and $X_{res}=1$.
- 4) Go to **Graph** and check your graph.
- 5) Go to **2nd Trace**
- 6) Go to **5:intersect**
- 7) Press **Enter** three times.
- 8) It will tell you the intersection point of the two graphs, which is "40 games" where both their earnings are equal.

Extended Response Coding Guide Academic Program

Task #2 — Stretch Signs a Basketball Contract

b — blank: nothing at all is written for the solution

u — unrelated or unengaged: the student has written “I don’t know” or a question mark; the student has simply rewritten the question exactly as posed; the student has offered unrelated comments or drawn pictures; the student has not engaged in the problem solution

Erasures — Do not code erased work.

Category Definitions				
KU	The knowledge of concepts and the ability to carry out procedures (e.g., operations, algorithms) to solve problems.			
AP	The selection of concepts, procedures, algorithms, tools and prior knowledge and fitting them into the context and the information in the problem.			
PS	The processes of using reasoning to pull together information in a problem, manipulating and transforming the information in a problem in order to see a solution, and reflecting on the solution to see restrictions and judge how well the solution answers the problem.			
Cat	Parts/Strand	Codes	Descriptions	
KU	a)	N	1	<ul style="list-style-type: none"> table incomplete (only the first 2 entries included) with 2 errors
			2	<ul style="list-style-type: none"> table incomplete (only first 2 entries included) with one error
			3	<ul style="list-style-type: none"> table complete (3 or more entries) with two or more errors
			4	<ul style="list-style-type: none"> table complete (3 or more entries) with one error (e.g., calculates money earned without accounting for signing bonus but is consistent through all the calculations)
			5	<ul style="list-style-type: none"> table accurate but incomplete (only first 2 entries included)
			6	<ul style="list-style-type: none"> table completed accurately [i.e., (10, 1 250 000), (20, 2 250 000), 1, 2 or 3 other correct ordered pairs, e.g., (30, 3 250 000), (40, 4 250 000), (50, 5 250 000)]
KU	b)	G	1	<ul style="list-style-type: none"> two or more errors in plotting points based on table of values
			2	<ul style="list-style-type: none"> one error in plotting points based on table of values
			3	<ul style="list-style-type: none"> ordered pairs plotted correctly based on table of values
	c)	G	1	<ul style="list-style-type: none"> no correct solutions for parts i, ii, iii
			2	<ul style="list-style-type: none"> correct solution for one of the parts as indicated in code 4
			3	<ul style="list-style-type: none"> correct solutions for two of the parts as indicated in code 4
			4	<ul style="list-style-type: none"> correct solutions for all parts [i.e., i: equation (e.g., $E = 100\,000n + 250\,000$); ii: well defined variables (e.g., E represents his earnings in dollars, n represents the number of games); iii: correct identification of numbers representing signing bonus and earnings per game (e.g., 250 000 is the amount of his signing bonus, 100 000 is the amount paid per game)]
			5	<ul style="list-style-type: none"> correct solutions for all parts as indicated in code 4
AP	b)	G	1	<ul style="list-style-type: none"> inappropriate choice of scale and irregular increments for both axes (e.g., horizontal axis spans 0 to 50 games, vertical axis spans 0 to 5 million dollars, both have irregular increments)
			2	<ul style="list-style-type: none"> inappropriate choice of scale but regular increments for both axes (e.g., horizontal axis spans 0 to 50 games, vertical axis spans 0 to 5 million dollars, both have appropriate increments)
			3	<ul style="list-style-type: none"> appropriate choice of scale for one of the axes with irregular increments on either axis or both axes (e.g., horizontal axis spans 0 to 50 games, vertical axis spans 0 to at least 9 million dollars with irregular increments on the vertical axis)
			4	<ul style="list-style-type: none"> appropriate choice of scale for one of the axes with regular increments on both axes (e.g., horizontal axis spans 0 to 50 games, vertical axis spans 0 to at least 9 million dollars)
			5	<ul style="list-style-type: none"> appropriate choice of scale for both axes with regular increments on both axes (e.g., horizontal axis spans 0 to at least 85 games, vertical axis spans 0 to at least 9 million dollars and both have appropriate increments)
	d)	G	1	<ul style="list-style-type: none"> improper choice of tool
			2	<ul style="list-style-type: none"> proper choice of tool (e.g., interpolating from graph, solving equation, or words) fitted inappropriately to the context (e.g., uses the graph but reads the answer from the incorrect axis)
			3	<ul style="list-style-type: none"> proper choice of tool (e.g., interpolating from graph, solving equation, or words) fitted partially to the context (e.g., solves the equation $E = 100\,000 + 250\,000(44)$ or adds bonus to pay per game before multiplying) to arrive at an incorrect answer
			4	<ul style="list-style-type: none"> proper choice of tool (e.g., interpolating from graph, solving equation, or words) fitted appropriately to the context [e.g., solves the equation $E = 250\,000 + 100\,000(44)$ properly to arrive at the correct answer of \$4 650 000]
			5	<ul style="list-style-type: none"> proper choice of tool (e.g., interpolating from graph, solving equation, or words) fitted appropriately to the context
			6	<ul style="list-style-type: none"> proper choice of tool (e.g., interpolating from graph, solving equation, or words) fitted appropriately to the context
			7	<ul style="list-style-type: none"> proper choice of tool (e.g., interpolating from graph, solving equation, or words) fitted appropriately to the context

Extended Response Coding Guide Academic Program

Task #2 — Stretch Signs a Basketball Contract

b — blank: nothing at all is written for the solution

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Category Definitions				
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AP	The selection of concepts, procedures, algorithms, tools and prior knowledge and fitting them into the context and the information in the problem.			
PS	The processes of using reasoning to pull together information in a problem, manipulating and transforming the information in a problem in order to see a solution, and reflecting on the solution to see restrictions and judge how well the solution answers the problem.			
Cat	Parts/Strand	Codes	Descriptions	
PS	e)	N	1	<ul style="list-style-type: none"> limited reasoning with inappropriate or no conclusions drawn or conclusion about the better offer but no reasoning shown
			2	<ul style="list-style-type: none"> some logical reasoning with conclusions inappropriate to this reasoning (e.g., creates a chart that shows Rory’s offer is better, but concludes that Stretch’s offer is better)
			3	<ul style="list-style-type: none"> limited reasoning with conclusions appropriate to this reasoning based on work done in previous sections (e.g., creates a chart for Rory’s earnings but does not extend it far enough and concludes that Rory’s offer is better for any number of games or compares amounts for one number of games only)
			4	<ul style="list-style-type: none"> some logical reasoning with conclusions appropriate to the reasoning based on work done in previous sections, does not consider the full context of the problem (e.g., compares offers without referring to specific numbers of games played, no reference to point of intersection)
			5	<ul style="list-style-type: none"> consistently logical reasoning and conclusions appropriate to the reasoning in the full context of the problem based on work done in previous sections (e.g., uses a chart, graph, an algebraic method or trial and error to determine the better offer for various numbers of games: at 40 games Rory and Stretch make the same amount of money; fewer than 40 games, Rory makes more; more than 40 games, Stretch makes more) <p>Note: There may be some variation in the number of games, depending on the method used to find the intersection point.</p>
CM	e)	th	Presentation of thinking: The consistency, quality and language of solutions and explanations of reasoning	
			1	<ul style="list-style-type: none"> communication is unclear and incomplete and does not reveal the thinking process
			2	<ul style="list-style-type: none"> communication is somewhat clear and complete and reveals some of the thinking process
			3	<ul style="list-style-type: none"> communication is mostly clear and complete and reveals the thinking process
			4	<ul style="list-style-type: none"> communication is clear and complete and reveals the thinking process
CM	c), d), e)	co	Mathematical conventions: The consistency, quality, selection and integration of symbols, vocabulary and mathematical forms used	
			1	<ul style="list-style-type: none"> mathematical conventions are not used properly when required
			2	<ul style="list-style-type: none"> mathematical conventions are rarely used properly when required
			3	<ul style="list-style-type: none"> mathematical conventions are usually used properly when required
			4	<ul style="list-style-type: none"> mathematical conventions are used properly when required (e.g., units and symbols used properly and complete equations given) <p>Note: missing \$ in c) iii) should not be considered an error</p>

Rationale For Coding of Student Work Academic Items

Task #2 — Stretch Signs a Basketball Contract

Category	Portion of Task	Code	Rationale
KU	a)	6	The table is completed accurately.
KU	b)	3	The ordered pairs from the table are plotted correctly.
KU	c)	4	$E = 100\,000(n) + 250\,000$ is a correct equation; the variables E and n are well defined; the student identifies 250 000 as the signing bonus and 100 000 as the amount paid per game.
AP	b)	5	Appropriate choice of scale and regular increments have been selected for both axes.
AP	d)	4	The appropriate choice of a tool (the equation) is fitted appropriately to the context ($n = 44$) to arrive at a correct answer of \$4 650 000.
PS	e)	5	The student uses a chart to determine the point at which both players earn the same amount of money. Appropriate conclusions are then made, supported by logical reasoning based on the number of games played. The student then verifies the chart by using the graphing calculator to determine the actual point of intersection.
CM	e)	4	Communication is clear and complete and reveals the thinking process in part e).
CM	c), d), e)	4	Units and symbols are used properly; complete equations are given in parts c), d) and e).

Task 3: Fitness Club

Suzanne wants to join a fitness club. Different clubs have different fee structures.

Gym Plus charges a membership fee of \$200. In addition, Suzanne would have to pay \$10 for each visit to the club.



- a) Calculate the **total** cost (membership fee plus the cost of visits) if Suzanne joins Gym Plus and visits the club 20 times. **Show your work.**

$$\begin{aligned}
 \overset{\text{total cost}}{C} &= 200 + 10v \quad \overset{\text{\# of visits}}{v} \\
 &= 200 + 10(20) \\
 &= \$400
 \end{aligned}$$

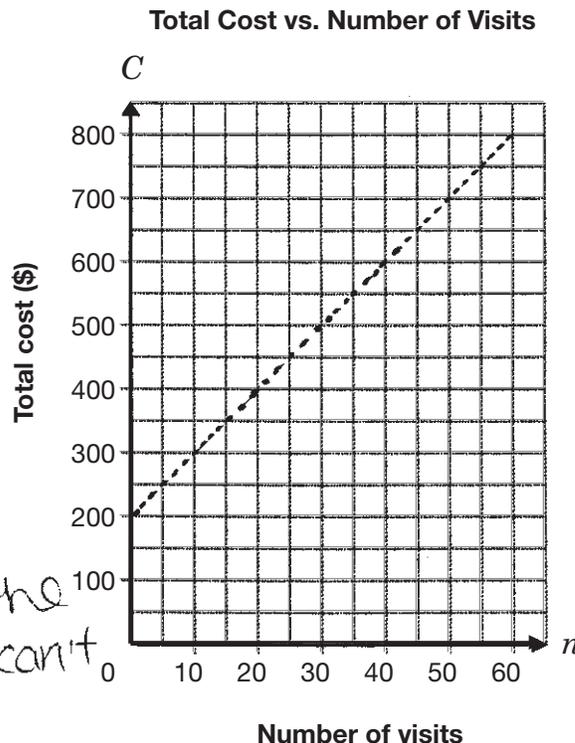
\therefore Suzanne would have to pay \$400

- b) **Graph** the relationship between the **total** cost, C , in dollars, of joining Gym Plus and making n visits to the club.

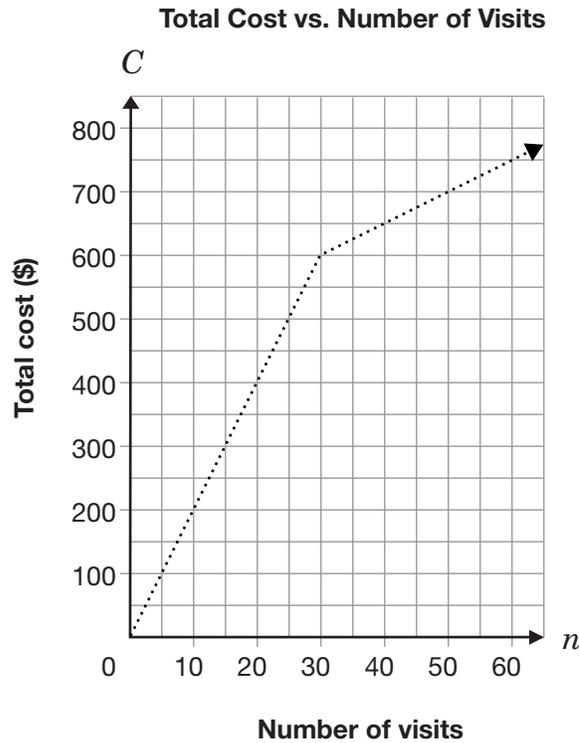
Describe the information you used to graph your line.

n	C
0	200
10	300
20	400
30	500
40	600
50	700
60	800

I used the formula of the fee structure and inserted the number of visits. Then, I graphed the points. Instead of joining the points, I put a dotted line (you can't have 1.5 visits, or 3.7 visits)



- c) Another club, Fit City, has a different fee structure, shown in the graph below.
Describe the fee structure of Fit City, giving details about costs and number of visits.



n	C
0	0
10	200
20	400
30	600
40	650
50	700
60	850

$200 \rightarrow 200 \rightarrow 20\%_{10} = 20$
 $400 \rightarrow 200$
 $600 \rightarrow 200$
 $650 \rightarrow 50 \rightarrow 5\%_{10} = 5$
 $700 \rightarrow 50$
 $850 \rightarrow 150$

change in graph

At Fit City, there is no flat rate. You have to pay \$20 for each visit until your 30th visit. After that, you only have to pay \$5 per visit.

d) A third club, Activity World, has a different fee structure.

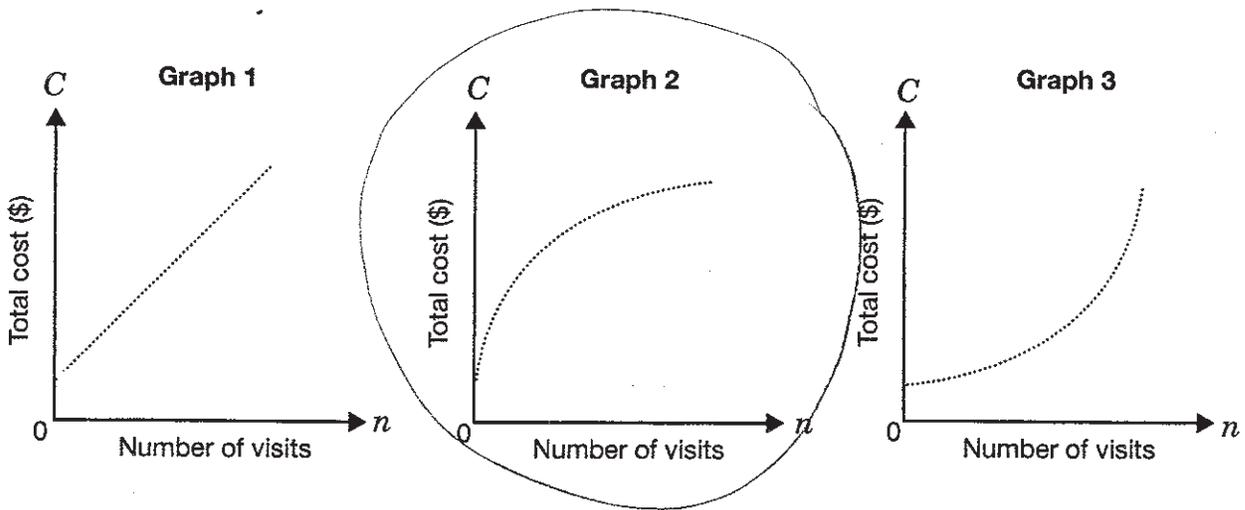
Suzanne would have to pay a membership fee and a certain amount every time she visits the club.

However, the amount she pays each time is reduced with each visit she makes.

Circle the graph that best represents this fee structure.

Give reasons why you chose the graph that you did.

Total Cost vs. Number of Visits



price of the visit.

Graph 2 shows the correct fee structure. It starts with a flat rate, and each "dot" rises a bit less than the one before. It shows the gradual decrease of the prices.

Graph 1 is linear, meaning each visit costs the same. Graph 3 shows a gradual increase in fee, not a decrease.



Extended Response Coding Guide Academic Program

Task #3 — Fitness Club

b — blank: nothing at all is written for the solution

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Cat	Parts/Strand	Codes	Descriptions	
KU	a)	R	1	<ul style="list-style-type: none"> incorrect answer, little or no work shown
			2	<ul style="list-style-type: none"> correct answer with no work shown or one error with appropriate work shown
			3	<ul style="list-style-type: none"> correct answer with appropriate work shown [e.g., $C = 200 + 20(10) = 400$]
AP	b)	R	1	<ul style="list-style-type: none"> more than 2 errors in plotting, inappropriate or no line drawn
			2	<ul style="list-style-type: none"> 1 or 2 errors in plotting, inappropriate or no line drawn
			3	<ul style="list-style-type: none"> one error in plotting points, appropriate line drawn or points plotted correctly, points joined inappropriately
			4	<ul style="list-style-type: none"> description shows appropriate tool(s) chosen [e.g., C-intercept and answer in a) or C-intercept and slope (i.e., \$10/visit)], fitted appropriately to the context (i.e., correct graph drawn)
AP	c)	R	1	<ul style="list-style-type: none"> incorrect description of the relationship based on the graph
			2	<ul style="list-style-type: none"> correct but incomplete description of the relationship based on the graph (e.g., “The cost increases with the number of visits.”)
			3	<ul style="list-style-type: none"> correct and partially complete description of the relationship based on the graph (e.g., “There is no membership fee and the cost per visit changes after 30 visits.”) or partially correct description of the relationship based on the graph (e.g., “There is no membership fee; it costs \$30/visit up to 30 visits and then less than that.”)
			4	<ul style="list-style-type: none"> correct and complete description of the relationship based on the graph (e.g., “There is no membership fee; the cost per visit is \$20 for up to 30 visits and \$5 for more than 30 visits.”)
PS	d)	R	1	<ul style="list-style-type: none"> incorrect or no conclusion with no reasoning or illogical reasoning
			2	<ul style="list-style-type: none"> correct conclusion with limited reasoning (e.g., “Graph 2 because it increases less than Graph 3.”)
			3	<ul style="list-style-type: none"> correct conclusion, supported by partially logical reasoning (e.g., “Graph 2 because the increase slows down.”)
			4	<ul style="list-style-type: none"> correct conclusion, supported by logical reasoning (e.g., “Graph 2, since the increase in the C-value decreases as n increases. Graph 1 is a straight line, which shows that the C-value increases at the same rate, and Graph 2 curves up, which shows that the increase in the C-value increases as n increases”)
CM	Presentation of thinking: The consistency, quality and language of solutions and explanations of reasoning			
	all	th	1	<ul style="list-style-type: none"> communication is unclear and incomplete and does not reveal the thinking process
			2	<ul style="list-style-type: none"> communication is somewhat clear and complete and reveals some of the thinking process
			3	<ul style="list-style-type: none"> communication is mostly clear and complete and reveals most of the thinking process
			4	<ul style="list-style-type: none"> communication is clear and complete and reveals the thinking process
CM	Mathematical conventions: The consistency, quality, selection and integration of symbols, vocabulary and mathematical forms used			
	all	co	1	<ul style="list-style-type: none"> mathematical conventions are rarely used properly when required
			2	<ul style="list-style-type: none"> mathematical conventions are sometimes used properly when required
			3	<ul style="list-style-type: none"> mathematical conventions are mostly used properly when required
			4	<ul style="list-style-type: none"> mathematical conventions [e.g., units (e.g., \$), symbols (e.g., variables)] are used properly when required

Rationale For Coding of Student Work Academic Items

Task #3 – Fitness Club

Category	Portion of Task	Code	Rationale
KU	a)	3	Correct answer of \$400 with appropriate work shown.
AP	b)	4	Explanation and table of values demonstrate the use of the fee structure fitted appropriately to the context to draw the graph correctly.
AP	c)	4	A complete description of the fee structure for Fit City is supported with details of cost and the number of visits.
PS	d)	4	Correctly identifies and provides appropriate reasoning for selecting Graph 2 as the graph that best represents Activity World's fee structure.
CM	all	4	Communication is clear and complete and reveals the thinking process for all parts of the task.
CM	all	4	Mathematical conventions (e.g., units, variables, tables of values and equations) are used properly throughout the task.