



Grade 9 Mathematics End-of-Term Exam Sample Paper

Grade	9	Chapters	1-5	Coursebook Pages	all
Student Name				Class	Date

Multiple Choice: CALCULATOR NOT ALLOWED

1	Determine if the function is a linear function. Explain your reasoning.	
	$\{(-4, 13), (-2, 1), (0, -3), (2, 1), (4, 13)\}$	
	A	This is a linear function because the constant change in x is 2.
	B	This is a linear function because there are y -values that repeat.
	C	This is a nonlinear function because there are no points in the third or fourth quadrants.
D	This is a nonlinear function because the constant change in x does not corresponds to a constant change in y .	

2	The profit a store makes is found by subtracting the cost C to produce an item from the amount earned in sales S . The cost and the sales can be modeled by the following equations, where x is the number of items produced.	
	$C = 75x^2 + 250x - 150$ $S = 120x^2 + 300x + 50$	
	Find an expression that models the profit.	
	A	$-45x^2 - 50x - 200$
	B	$-45x^2 - 50x - 100$
C	$45x^2 + 50x - 100$	
D	$45x^2 + 50x + 200$	

3	Which of the following is the expression in simplest form?	
	$(3w^2r)^2(-2w^5r^2)^3$	
	A	$-72w^{19}r^8$
	B	$-36w^{32}r^{10}$
	C	$-6w^{19}r^6$
D	$-6w^{12}r^7$	



Grade 9 Mathematics End-of-Term Exam Sample Paper

4	If $7n + 3 = \frac{4}{3}$, what is the value of $7n + 5$?	
	A	$-\frac{5}{3}$
	B	$-\frac{5}{21}$
	C	$\frac{10}{3}$
D	$\frac{13}{3}$	

5	Find an expression for c that will make $9x^2 + 12xy + c$ a perfect square trinomial.	
	A	y^2
	B	$4y^2$
	C	$16y^2$
D	The value does not exist.	

6	Solve $216^{x+1} = 6$.	
	A	$-\frac{3}{4}$
	B	$-\frac{2}{3}$
	C	1
D	2	

7	When the product of $3w^2 + 9c$ and $3w^2 - 9c$ is written in standard form, what is the second term?	
	A	$-81c^2$
	B	$-27cw^2$
	C	$9w^4$
D	$54cw^2$	

8	Determine if the sequence below is a geometric sequence. If so, what is the common ratio? $64, -32, 16, -8, 4, \dots$	
	A	geometric; $r = -\frac{1}{2}$
	B	geometric; $r = \frac{1}{2}$
	C	geometric; $r = 2$
D	not geometric	



Grade 9 Mathematics End-of-Term Exam Sample Paper

9	Which of the following is one factor of the polynomial below?	
	$5x^2 - 6x + 1$	
	A	$5x - 1$
	B	$2x + 3$
	C	$x - 2$
D	$x + 3$	

10	Which of the inequalities describes the graph shown below?	
	A	$y \geq -2x $
	B	$y \leq -2x $
	C	$y > -2x $
D	$y < -2x $	



Grade 9 Mathematics End-of-Term Exam Sample Paper

11	An air conditioning technician charges a service fee of AED 200 plus AED 80 per hour for labor. Which of the following represents an equation, in standard form, for the total cost y if the technician works x hours?	
	A	$80x + y = 200$
	B	$80x - y = -200$
	C	$200x + y = -80$
	D	$200x - y = -80$

12	Solve $2^{3x+10} = 128$.	
	A	$-\frac{4}{3}$
	B	-1
	C	$-\frac{2}{3}$
	D	7

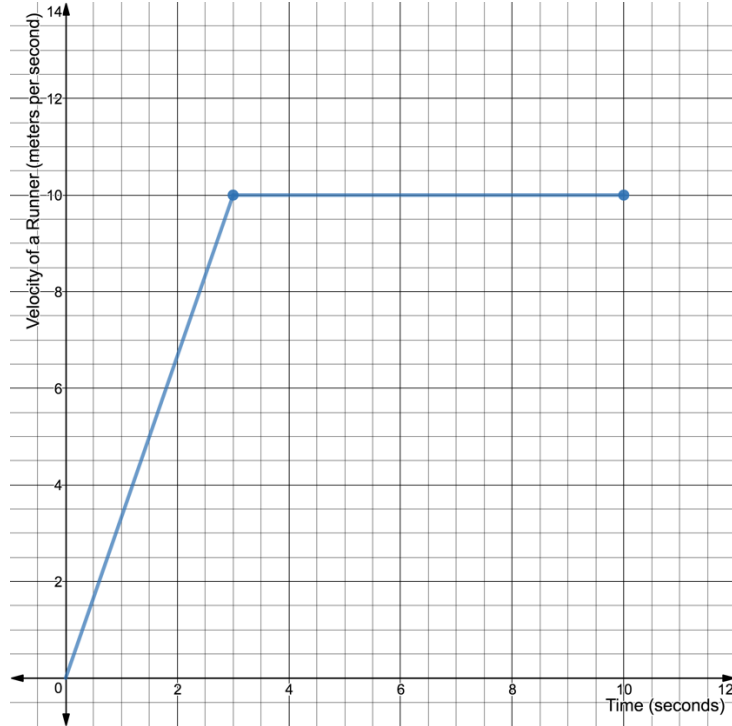
13	Which of the following is the expression in simplest form?	
	$\frac{(z^2w^{-1})^3}{(z^3w^2)^2}$	
	A	$\frac{z^{12}}{w^7}$
	B	$\frac{1}{w}$
	C	$\frac{1}{w^7}$
D	w	



Grade 9 Mathematics End-of-Term Exam Sample Paper

14

The graph below shows the velocity, in meters per second, of a runner.



Find the average rate of change of velocity over the interval $t = 0$ to $t = 3$ seconds.

- | | |
|---|----------------|
| A | $\frac{3}{10}$ |
| B | $\frac{10}{3}$ |
| C | zero |
| D | undefined |

15

Using $a_n = a_1 r^{n-1}$, which of the following is an equation for the n th term of the sequence?

$$11, \frac{11}{2}, \frac{11}{4}, \frac{11}{8}, \frac{11}{16}, \dots$$

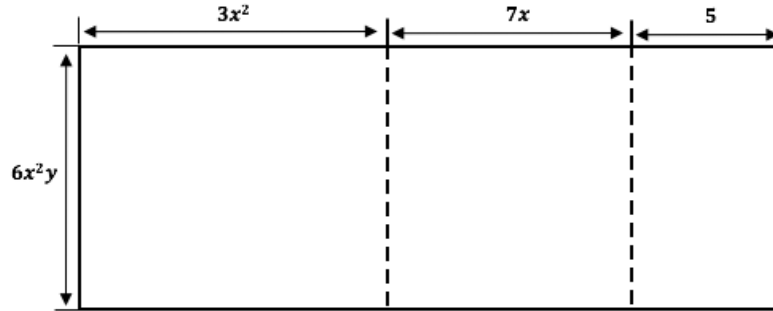
- | | |
|---|--|
| A | $a_n = 121^{n-1}$ |
| B | $a_n = 11(11)^{n-1}$ |
| C | $a_n = 5\left(\frac{1}{2}\right)^{n-1}$ |
| D | $a_n = 11\left(\frac{1}{2}\right)^{n-1}$ |



Grade 9 Mathematics End-of-Term Exam Sample Paper

16

The diagram below shows a courtyard divided into three sections. Which of the following represents the area of the courtyard in square units?



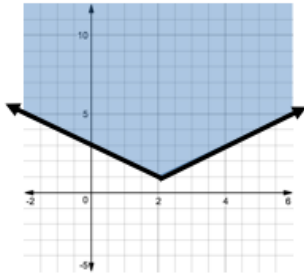
- | | |
|----------|----------------------------|
| A | $9x^2y + 13xy + 11y$ |
| B | $9x^4y + 13x^3y + 11x^2y$ |
| C | $18x^2y + 42xy + 30y$ |
| D | $18x^4y + 42x^3y + 30x^2y$ |



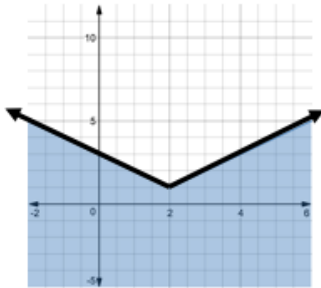
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Which of the following is the graph of $y \leq |x - 2| + 1$?

A

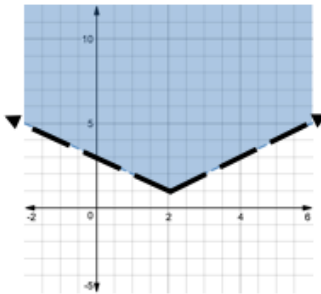


B

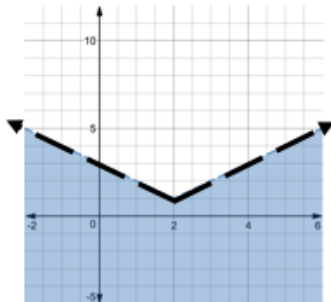


17

C



D





Grade 9 Mathematics End-of-Term Exam Sample Paper

18

The electrical current I , in amps, passing through an electronic component varies directly with the applied voltage V , in volts, according to the relationship $V = I \cdot R$, where R is the resistance, in ohms.

The resistance of a circuit is $5x + 20$ ohms, and a voltage of 120 volts produces a current of 2.5 amps. Which of the following is an equation that describes this relationship? Calculate the resistance of the unknown component.

- | | |
|---|---------------------------------|
| A | $2.5 = 120(5x + 20)$; 5.6 ohms |
| B | $2.5 = 120(5x + 20)$; 48 ohms |
| C | $120 = 2.5(5x + 20)$; 5.6 ohms |
| D | $120 = 2.5(5x + 20)$; 48 ohms |

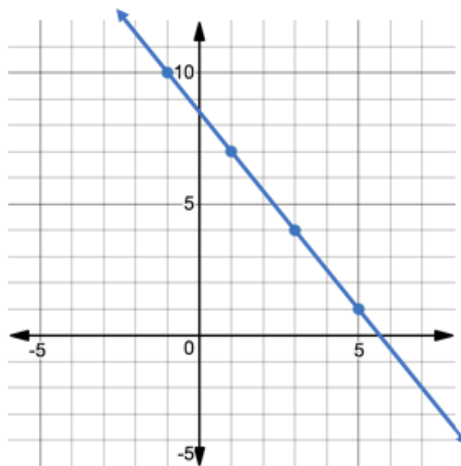
19

Which of the following is a solution of $12w^2 = 75$?

- | | |
|---|-------------|
| A | 2.5 |
| B | 3 |
| C | 6.25 |
| D | no solution |

20

Find the slope of the line shown below.



- | | |
|---|----------------|
| A | $-\frac{3}{2}$ |
| B | $-\frac{2}{3}$ |
| C | $\frac{2}{3}$ |
| D | $\frac{3}{2}$ |



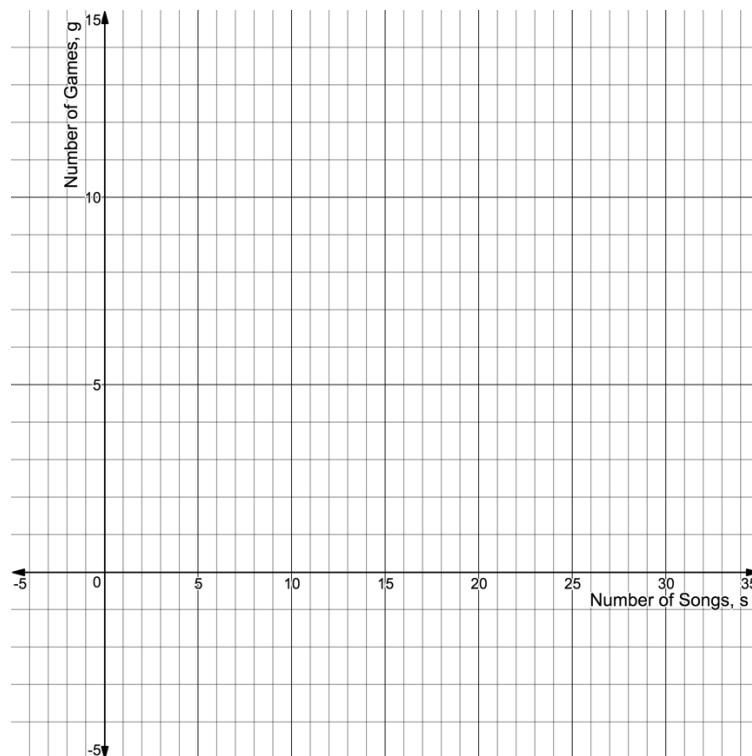
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Constructed Response: CALCULATOR ALLOWED

Husam received a gift card worth AED 90 to an online store that sells digital music and games. Each song costs AED 3, and each game costs AED 9.

- a) Let s represent the number of songs purchased and g represent the number of games purchased. Write a linear inequality that represents the number of songs and the number of games Husam can purchase.

- b) Create a graph of the inequality above.



- c) Can Husam buy 25 songs and 15 games with this gift card? Explain your reasoning.

(/6 marks)



Grade 9 Mathematics End-of-Term Exam Sample Paper

A company produces a certain number of toys in a day. The cost to produce **each** toy was found to be AED 65 minus the number of toys produced in a day. The total cost of production is calculated by multiplying the certain number of toys by the cost to produce each toy. On Saturday, the total cost was found to be AED 1050.

- a) Write a quadratic equation that represents the total cost on Saturday.

- b) What are the solutions of this equation?

- c) What is **one** possible number of toys produced on Saturday? _____

- d) Is there another possible number of toys produced on Saturday? Explain your reasoning.

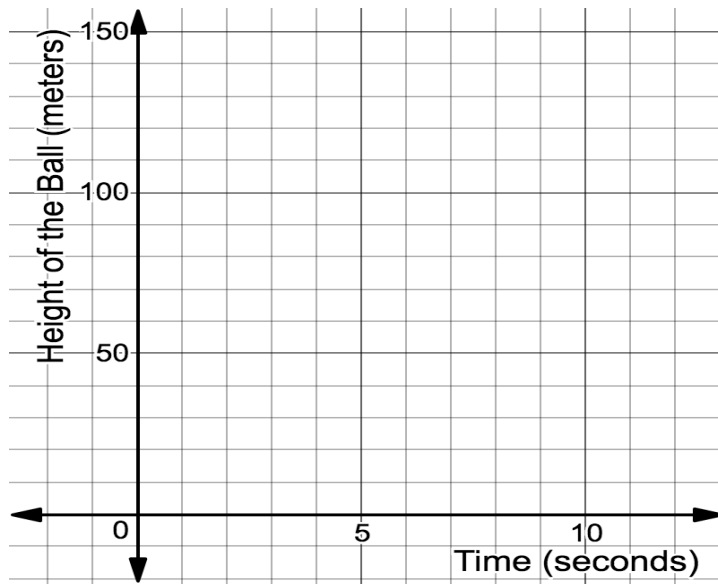
(/5 marks)



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A ball is thrown upwards from a rooftop 80 meters above the ground. It will reach a maximum vertical height and then fall back to the ground. The height of the ball from the ground at time t is h and is represented by the quadratic equation $h = -16t^2 + 64t + 80$.

- a) Graph the equation, being sure to **label** the vertex and the intercepts.



23

- b) What is the maximum height the ball will reach?

- c) How long will it take for the ball to hit the ground?

- d) Explain why there is one value that cannot be used to answer part c.

(/6 marks)



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Use $2x^2 + 3x - 5 = 0$ to complete the following:

- a) Show **all** your work to solve by completing the square.

- b) Using the quadratic formula, explain if your solutions should be the same.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

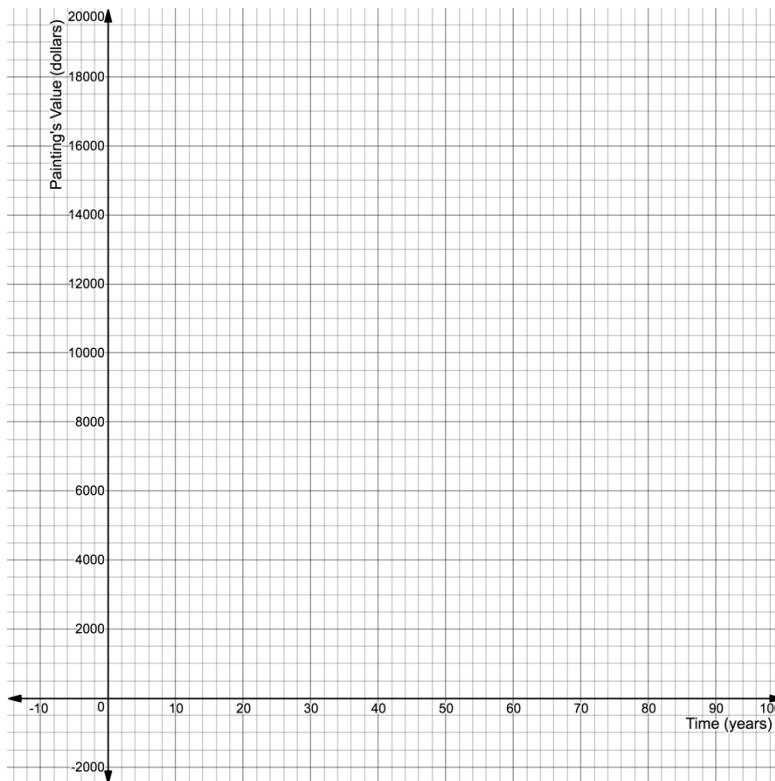


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A rare painting is being sold for \$6000, and experts believe its value will increase by 1.4% annually.

- a) Using $y = a(1 + r)^t$, write a growth model for the value of the painting, y , after t years.

- b) Graph the model, being sure to **label** the y-intercept and at least two other points.



25

- c) Find the expected value after 10 years. Round if necessary.

- d) Using the graph, estimate how long it will take for the painting's value to double.
Explain your reasoning.

(/6 marks)



Grade 9 Mathematics End-of-Term Exam Sample Paper

Multiple Choice	/20
Constructed Response	/30
Total Marks	/50
Percentage	/100%



Grade 9 Mathematics End-of-Term Exam Sample Paper

Answer Key

Multiple Choice

Q1	D
Q2	D
Q3	A
Q4	C
Q5	B
Q6	B
Q7	A
Q8	A
Q9	A
Q10	C
Q11	B
Q12	B
Q13	C
Q14	B
Q15	D
Q16	D
Q17	B
Q18	D
Q19	A
Q20	A



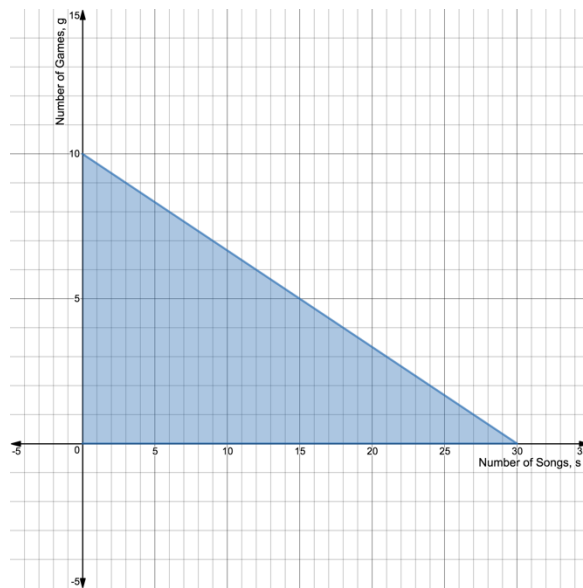
Grade 9 Mathematics End-of-Term Exam Sample Paper

Constructed Response

- a) One mark should be awarded for $g \leq -\frac{1}{3}s + 10$ or $3s + 9g \leq 90$.
If the student writes an equivalent equation, still award the mark.
*If the student writes $g \leq -3s + 30$, $9s + 3g \leq 90$, or an equivalent, do **not** award the mark.*
- b) One mark should be awarded for a solid line with an x -intercept of 30 and a y -intercept of 10.
If the student gets the equation in part a wrong but graphs their equation correctly, still award the mark.

One mark should be awarded for the line meeting the conditions of $0 \leq s \leq 30$.

One mark should be awarded for shading below the line.
If the student shades below the x -axis and to the left of the y -axis, still award the mark.



- c) One mark should be awarded for “no.”

One mark should be awarded for an explanation that (25, 15) lies outside of the shaded region, thus not satisfying the inequality.

If the student explains that the cost will exceed AED 90, still award the mark.

6 marks



Grade 9 Mathematics End-of-Term Exam Sample Paper

22

- a) One mark should be awarded for $x(65 - x) = 1050$, $-x^2 + 65x - 1050 = 0$, $x^2 - 65x + 1050 = 0$, or some other equivalent equation.
The variable chosen is not of importance.
- b) One mark should be awarded for $x = 30$ and $x = 35$.
If the student simply writes 30 and 35, still award the mark.
If the student gets the equation in part a wrong but solves their equation correctly, still award the mark.
- c) One mark should be awarded for either 30 toys or 35 toys. The student is only required to write one of the solutions.
If the student excludes the units, still award the mark.
- d) One mark should be awarded for “yes.”

One mark should be awarded for an explanation that both 30 and 35 satisfy the equation.

Use your professional judgement when awarding this mark. The student can give an explanation about satisfying the quadratic equation, but s/he can also explain based on the context of the problem. For example, if 30 toys were produced on Saturday, that would equal a production cost of AED 35, and 30 times 35 is equal to 1050. If 35 toys were produced on Saturday, that would equal a production cost of AED 30, and 35 times 30 is equal to 1050.

5 marks



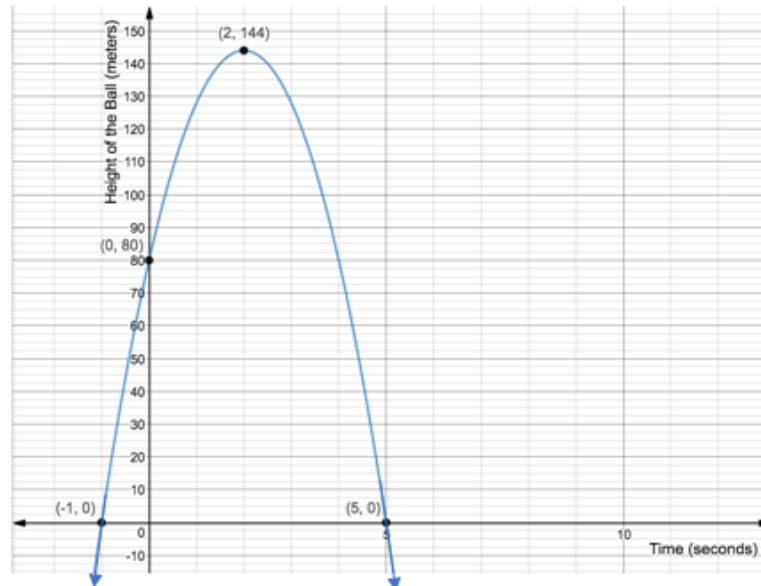
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- a) One mark should be awarded for labeling the vertex of $(2, 144)$.
Pay attention to the scaling of the graph. The student's point should make sense in its position.

One mark should be awarded for labeling the x -intercept of $(-1, 0)$ and $(5, 0)$ as well a y -intercept of $(0, 80)$.

One mark should be awarded for the curve going through the vertex and the intercepts above.

If the student stops the curve at the x -axis, still award the mark. This student understands constraints. Regardless, the directions were not to graph the situation but the quadratic equation.



23

- b) One mark should be awarded for a maximum height of 144 meters.
If the student does not write the units, still award the mark.
- c) One mark should be awarded for explaining -1 second in this situation, **OR** the ball was thrown into the air from a height of 80 meters (the y -intercept) at 0 seconds.
Use your professional judgement when awarding this mark. If the student gives a different but mathematically valid reason, still award the mark.

6 marks



Grade 9 Mathematics End-of-Term Exam Sample Paper

24

- a) One mark should be awarded for $2x^2 + 3x = 5$.

One mark should be awarded for dividing each term by 2, making $a = 1$.

One mark should be awarded for adding $\frac{9}{16}$ or $(\frac{3}{4})^2$ to both sides of the equation.
If the student adds an equivalent, still award the mark.

One mark should be awarded for finding the square root of each side.

Two final marks should be given for the solution $x = -\frac{5}{2}$ and $x = 1$

If the student simply writes $-\frac{5}{2}$ and 1, still award the marks.

If the student writes an equivalent form of either solution, still award the marks.

- b) One mark should be awarded for an explanation that the solutions should be the same because the quadratic equation is the same, just the method for solving is different.

7 marks



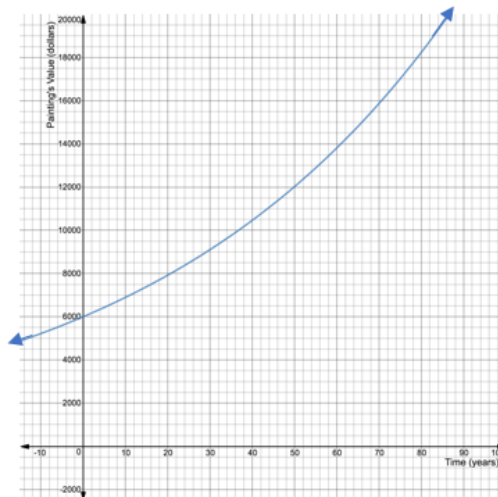
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- a) One mark should be awarded for $y = 6000(1 + 0.014)^t$ or $y = 6000(1.014)^t$.
If the students used 14 or 0.14 for r , do **not** award the mark.

- b) One mark should be awarded for labeling the y -intercept of (0, 6000) and two other points on the graph.
Pay attention to the scaling of the graph. The student's point should make sense in its position, but it will not be exact, hence the labeling.

One mark should be awarded for the curve going through the y -intercept and at least two other points.

If the student stops the curve at the y -axis, still award the mark. This student understands constraints. Regardless, the directions were not to graph the situation but the exponential equation.



- c) One mark should be awarded for \$6895, \$6894.90, or \$6894.94.
If the student does not write the units, still award the mark.
If the student rounds to the nearest ten, hundred, or thousand dollars, still award the mark.
If the student writes the value in words "between ____ and ____," still award the mark.
- d) One mark should be awarded for an estimate based on the graph.
The prediction should be between 40 and 60 years, but check their estimate against their graph.

One mark should be awarded for an explanation of the prediction based on the graph.
If the student computes this algebraically, still award the mark.

6 marks



Grade 9 Mathematics End-of-Term Exam Sample Paper

Data Analysis Information

Use the information below to help you determine which student learning outcomes are not being met by the majority of your students. This will help you make determinations about re-teaching, spiraling content not mastered, and implementing other interventions without interrupting the scheme of work.

Question	Lesson	Student Learning Outcome(s)
1	2-2	Identify linear relations and functions.
2	3-1	Write polynomials in standard form. Subtract polynomials.
3	5-1	Multiply monomials using the properties of exponents. Simplify expressions using the multiplication properties of exponents.
4	1-3	Solve equations using the properties of equality.
5	3-9	Factor perfect square trinomials.
6	5-3	Solve equations involving expressions with rational exponents.
7	3-4	Find the product of a sum and a difference.
8	5-7	Identify and generate geometric sequences.
9	3-7	Factor trinomials of the form $ax^2 + bx + c$. Solve equations of the form $ax^2 + bx + c = 0$.
10	1-6, 2-7	Solve absolute value inequalities. Graph absolute value inequalities.
11	2-2	Write linear equations in standard form.
12	5-3	Solve equations involving expressions with rational exponents.
13	5-2	Divide monomials using the properties of exponents. Simplify expressions containing negative and zero exponents.
14	2-3	Find rate of change.
15	5-7	Relate geometric sequences to exponential functions.
16	3-2	Multiply a polynomial by a monomial.
17	1-6, 2-7	Solve absolute value inequalities. Graph absolute value inequalities.
18	1-3	Solve equations using the properties of equality.
19	3-8	Factor binomials that are the difference of squares. Use the difference of squares to solve equations.
20	2-3	Determine the slope of a line.
21	2-7	Graph linear inequalities.
22	3-6	Factor trinomials of the form $x^2 + bx + c$. Solve equations of the form $x^2 + bx + c = 0$.
23	4-2	Solve quadratic equations by graphing. Estimate solutions of quadratic equations by graphing.
24	4-4, 4-5	Complete the square to write perfect square trinomials. Solve quadratic equations by completing the square. Solve quadratic equations by using the Quadratic Formula. Use the discriminant to determine the number of solutions of a quadratic equation.
25	5-5, 5-6	Graph exponential functions. Solve problems involving exponential growth.