Read the instructions below.

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Like this: ●

Not like this: ❌ ✔️ 🌑 🌙

Cleanly erase your answer if you wish to change it and fill in the circle for your new answer.

Fill in only one circle for each question.

1   ○   ○   ○   ○
2   ○   ○   ○   ○
3   ○   ○   ○   ○
4   ○   ○   ○   ○
5   ○   ○   ○   ○
6   ○   ○   ○   ○
7   ○   ○   ○   ○
8   ○   ○   ○   ○
9   ○   ○   ○   ○
10  ○   ○   ○   ○
11  ○   ○   ○   ○
12  ○   ○   ○   ○
To indicate your answer, use a pencil to fill in the appropriate circle below completely.

Like this: ●

Not like this: × ✔ ☐ ☐

Cleanly erase your answer if you wish to change it and fill in the circle for your new answer.

Fill in only one circle for each question.

19  ○ ○ ○ ○

20  ○ ○ ○ ○

21  ○ ○ ○ ○

22  ○ ○ ○ ○
1. The cost of granola bars at two different stores is shown below.

<table>
<thead>
<tr>
<th>Food-O-Rama</th>
<th>Groceryland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box of 12 granola bars</td>
<td>Each box has 5 granola bars</td>
</tr>
<tr>
<td>$7.44</td>
<td>2 boxes for $6.00</td>
</tr>
</tbody>
</table>

What is the difference in the cost per granola bar at these two stores?

- a) $ 2\,\$ 
- b) $ 6\,\$ 
- c) $ 58\,\$ 
- d) $ 62\,\$

2. Cornerstone High School has 1860 students.
   - 45% of the students bike or walk to school.
   - 372 students drive to school.
   - The remaining students travel to school by bus.

   How many students travel to school by bus?

- a) 651
- b) 837
- c) 1209
- d) 1443

3. What value of \( x \) makes the following equation true?

\[ \sqrt{x} = 16 \]

- a) 4
- b) 8
- c) 32
- d) 256

\[ \sqrt{256} = 16 \]
4. A cake is made of two cylindrical layers of ice cream stacked on top of each other as pictured below.

The formula for the volume of one layer of this cake, \( V \), is

\[
V = \pi r^2 h,
\]

where \( r \) is the radius of the layer and \( h \) is the height of the layer.

Which of the following is closest to the total volume of ice cream needed to make the two layers of this cake?

- a) 434 cm\(^3\)
- b) 867 cm\(^3\)
- c) 5448 cm\(^3\)
- d) 17 114 cm\(^3\)

5. Which of the following shows an appropriate line of best fit for the data?

a) ![Graph a](image1)

b) ![Graph b](image2)

c) ![Graph c](image3)

d) ![Graph d](image4)
6 The temperatures at 2 a.m. and 4 a.m. on a winter day are recorded in the table.

<table>
<thead>
<tr>
<th>Time</th>
<th>Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 a.m.</td>
<td>-8</td>
</tr>
<tr>
<td>3 a.m.</td>
<td>-5</td>
</tr>
<tr>
<td>4 a.m.</td>
<td>-2</td>
</tr>
<tr>
<td>5 a.m.</td>
<td>1</td>
</tr>
</tbody>
</table>

If the relationship between temperature and time is linear, what are the temperatures at 3 a.m. and 5 a.m.?

a. -4 °C and 0 °C  
   rate: \( \frac{6}{2} \)  
   [\( \frac{3}{1} \)]

b. -4 °C and 2 °C

c. 5 °C and 1 °C

d. -5 °C and 5 °C

7 Information about the amount of money Aamari has left at the end of each month is shown by the graph.

Aamari started with $300 and spent the same amount each month. He reached $0 after 6 months.

If Aamari had spent $100 more per month, and had started with $300, when would he have reached $0?

a. 2 months  
   rate: $150/month 

b. 3 months

c. 6 months

d. 8 months
8 Information about four different linear relationships is given below.

<table>
<thead>
<tr>
<th>Equation:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>$K = 2n + 7$</td>
<td>The total cost to print T-shirts is made up of a set-up fee of $65 and a cost of $7 per T-shirt.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$h$</td>
<td>$T$</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
</tr>
</tbody>
</table>

Graph:

Which two of these linear relationships have a rate of change of 7?

a. "Table" and "Graph"

b. "Table" and "Description"

c. "Equation" and "Graph"

d. "Equation" and "Description"

9 Joel has a summer job cutting lawns. The relationship between his profit, $P$, in dollars, and the number of lawns cut, $n$, is shown by the graph below.

![Graph showing the relationship between profit and number of lawns cut.]

What type of variation is the relationship, and what is its initial value?

a. a direct variation with an initial value of $5$

b. a direct variation with an initial value of $-100$

c. a partial variation with an initial value of $5$

d. a partial variation with an initial value of $-100$
10. The graph below represents information about the linear relationship between the total cost of a day at the fair and the number of rides taken.

![Total Cost vs. Number of Rides Taken](image)

Which of the following equations represents the relationship between $C$ and $r$?

- a) $C = 3r$
- b) $C = 9.5r$
- c) $C = 0.75r + 26$
- d) $C = 3r + 26$

11. Enviro-Car rents vehicles. The company is advertising a change in its total costs as shown below.

**Our Costs Are Changing**

**Old total cost:**
- $25 fixed cost
- $0.25 per km

**New total cost:**
- $32 fixed cost
- $0.15 per km

Enviro-Car plans to graph the relationship between the total cost, $C$, and number of kilometres, $n$, for both total costs.

How will the graph of the new total cost be different from the graph of the old total cost?

The graph of the new total cost will be

- a) steeper and start higher on the $C$-axis.
- b) steeper and start lower on the $C$-axis.
- c) less steep and start higher on the $C$-axis.
- d) less steep and start lower on the $C$-axis.

Change in rate:
- from $0.25/\text{km}$ to $0.15/\text{km}$.
Ariel and Hayden each have money in a bank account that does not give any interest. Hayden’s weekly account balance is shown by the graph below.

Ariel starts with $200 in her account and spends $20 each week, without making any deposits.

Which of the following is true?

a. Hayden will have less money in his account than Ariel in Week 5.
b. Hayden will always have more money in his account than Ariel.
c. Ariel starts with less money in her account than Hayden.
d. Ariel has more money in her account than Hayden in Week 4.
Hamburgers and Hot Dogs

At a local event, the ratio of hamburgers to hot dogs sold is 5:3.

The number of hamburgers sold is 275.

How many more hamburgers than hot dogs are sold?

Show your work.

\[ \frac{\text{hamb.}}{\text{hot}} = \frac{5}{3} \]
\[ \frac{5}{3} = \frac{275}{x} \]
\[ 5x = 3(275) \]
\[ 5x = 825 \]
\[ x = 165 \text{ hot dogs} \]

\[ \text{hamb.} - \text{hot dogs} \]
\[ 275 - 165 = \frac{110}{2} = 55 \text{ more hamb. sold than hot dogs} \]

There are ______ more hamburgers than hot dogs sold.
Great Lengths

The rectangular yard pictured below has algebraic expressions for its side lengths, in metres.

The perimeter of the yard is 126 m.

Complete the equation below so that it represents the perimeter of the yard.

\[126 = 2(2x - 1) + 2(3x)\]

Determine the value of \(x\) using your equation.

Show your work.

\[126 = 4x - 2 + 6x\]
\[0 = 10x - 128\]
\[128 = 10x\]
\[12.8 = x\]

The value of \(x\) is \(12.8\).
**Signed, Sealed and Delivered**

Two companies deliver packages. Information about the total cost, $C$, in dollars, for each company is given below.

**Flash Delivery**

$$C = 3d$$

$d$ represents the distance the package is shipped, in **kilometres**.

**Express Delivery**

![Total Cost vs. Mass of the Package](chart)

Complete the chart below by determining the initial value and the rate of change for each company. Describe the meaning of the rate of change in each situation.

<table>
<thead>
<tr>
<th><strong>Flash Delivery</strong></th>
<th><strong>Express Delivery</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial value: 0</td>
<td>Initial value: $5</td>
</tr>
<tr>
<td>Rate of change: 3</td>
<td>Rate of change: $\frac{5}{2}$</td>
</tr>
<tr>
<td>Meaning of the rate of change in this situation: $3 per km charged</td>
<td>Meaning of the rate of change in this situation: $\frac{5}{2}$ or $2.50 per kg</td>
</tr>
</tbody>
</table>
16 Charity Walk

Emily participates in a 10 km charity walk, where the walkers follow a straight path from the start then return along the same path to the finish. This graph shows the relationship between Emily’s distance from the start and her time.

![Graph showing distance from start vs. time]

Describe each segment of her walk. Include information about distance travelled, time, speed in km/min and direction.

<table>
<thead>
<tr>
<th>Segment</th>
<th>Distance travelled</th>
<th>Time</th>
<th>Speed (km/min)</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5 km</td>
<td>40 min</td>
<td>$\frac{5}{40} = 0.125$ km/min</td>
<td>away from start</td>
</tr>
<tr>
<td>B</td>
<td>0 km</td>
<td>10 min</td>
<td>0 km/min</td>
<td>stopped</td>
</tr>
<tr>
<td>C</td>
<td>5 km</td>
<td>50 min</td>
<td>$\frac{5}{50} = 0.1$ km/min</td>
<td>toward start</td>
</tr>
</tbody>
</table>
Grid School

The diagram on the grid below represents the shape of a school.

Determine the total area of the shape of the school.

Show your work.

\[ A_1 = l \times w \]
\[ = 50 \times 80 \]
\[ A_1 = 4000 \text{ m}^2 \]

\[ A_2 = \frac{bh}{2} \]
\[ = \frac{50(60)}{2} \]
\[ = 1500 \text{ m}^2 \]

\[ A_2 = \frac{\pi r^2}{2} \]
\[ = \frac{3.14(20^2)}{2} \]
\[ = 628 \text{ m}^2 \]

\[ A_4 = l \times w \]
\[ = 60 \times 50 \]
\[ A_4 = 3000 \text{ m}^2 \]

\[ A_{\text{TOTAL}} = 4000 + 1500 + 628 + 3000 \]
\[ A_{\text{TOTAL}} = 9128 \text{ m}^2 \]
## Magnificent Map

A map is pictured below.

![Map Diagram]

Complete the table below with the values of $x$ and $y$. Justify your answers using geometric properties.

<table>
<thead>
<tr>
<th>Value</th>
<th>Justification using geometric properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x = 104^\circ$</td>
<td>$SAT = 180 - 76 = 104^\circ$</td>
</tr>
</tbody>
</table>
| $y = 42^\circ$ | $\triangle SAT = 180^\circ$
  \[ 76 + 62 + y = 180 \]
  \[ 138 + y = 180 \]
  \[ y = 180 - 138 \]
  \[ y = 42^\circ \] |
The ramp pictured below is 12 m long and has a base of 10 m.

Which of the following is closest to the height, $h$, of the ramp?

a) 2 m  
b) 7 m  
c) 16 m  
d) 22 m

Orange Dream sells drinks in two sizes of cylindrical cans. The smaller can is pictured below.

The larger can has the same height and a radius that is triple the radius of the smaller can.

How many times larger is the volume of the larger can than that of the smaller can?

a) 3 times larger  
b) 9 times larger  
c) 12 times larger  
d) 27 times larger

\[ V = \pi r^2 h \]
\[ = 3.14 \times (4^2) \times (10) \]
\[ = 3.14 \times 16 \times 10 \]
\[ = 502.4 \text{ cm}^3 \]

For the larger can:
\[ V_{\text{larger}} = \pi r^2 h \]
\[ = 3.14 \times (12^2) \times (10) \]
\[ = 4521.6 \text{ cm}^3 \]

\[ \frac{V_{\text{larger}}}{V_{\text{smaller}}} = \frac{4521.6}{502.4} \]
\[ = 9 \]
21. What is the value of $x$ in the diagram below?

- a) $60^\circ$
- b) $68^\circ$
- c) $112^\circ$
- d) $128^\circ$

**Solution:**

The sum of interior angles is $180(n-2)$.

- $180(5-2) = 180(3) = 540^\circ$

Thus, $540 = 128 + 96 + 84 + 120 + x$

Solving for $x$:

$540 = 428 + x$

$x = 112^\circ$

22. What are the values of $x$ and $y$ in the diagram below?

- a) $x = 62^\circ$, $y = 62^\circ$
- b) $x = 62^\circ$, $y = 118^\circ$
- c) $x = 118^\circ$, $y = 118^\circ$
- d) $x = 118^\circ$, $y = 62^\circ$

**Solution:**

- $y = 180 - 62$
- $y = 118^\circ$
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Not like this:  ✗  ✓  ❌  ⬜

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<td></td>
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</tr>
</tbody>
</table>
To indicate your answer, use a pencil to fill in the appropriate circle below completely.

Like this: ●

Not like this: ✗ ✓ ✗ ●

Cleanly erase your answer if you wish to change it and fill in the circle for your new answer. Fill in only one circle for each question.

26  ● ● ● ● ●
27  ● ● ● ● ●
28  ● ● ● ● ●
29  ● ● ● ● ●
30  ● ● ● ● ●
31  ● ● ● ● ●
1. Which of the following ratios is equivalent to 2:5?
   a. 5:2
   b. 2:7
   c. 14:35
   d. 22:25

2. The ratio of boys to girls in Mandy’s mathematics class is 3 to 12.
   This ratio is the same in Mandy’s science class, in which there are 20 girls. How many boys are there in Mandy’s science class?
   a. 5
   b. 8
   c. 11
   d. 15

3. Jake and Minh buy food for a fundraiser.
   - One case of 24 hamburgers costs $37.
   - One case of 12 drinks costs $9.

   How much will the food for 72 meals cost if each meal is made up of 1 hamburger and 1 drink?
   a. $276
   b. $165
   c. $138
   d. $92

4. A school orders 120 calculators.
   The school receives a shipment containing 80% of the order, and 1 out of every 3 of these calculators is black.

   How many black calculators has the school received in this shipment?
   a. 32
   b. 40
   c. 50
   d. 96
5. What is the value of $-5 - (-3)$?
   a. -8
   b. -2
   c. 2
   d. 8

6. A line, square and cube are pictured below.

   Line
   ![Line Diagram]
   p       p

   Square
   ![Square Diagram]
   p
   p

   Cube
   ![Cube Diagram]
   p
   p

   Which of the following statements describes one of the above?
   a. The length of the line is $p^2$. ×
   b. The area of the square is $p^2$. ×
   c. The volume of the cube is $3p$. ×
   d. The perimeter of the square is $2p$. ×

7. Which of the following is a simplified form of the expression below?
   $7(3x + 5)$
   a. $56x$
   b. $10x + 12$
   c. $21x + 5$
   d. $21x + 35$
Information about the volume of a particular gas and its temperature is shown on the graph.

**Volume vs. Temperature**

Which of the following is true about the information represented in this graph?

a. The volume of the gas is less at R than at P.

b. The volume of the gas is greater at Q than at R.

c. The temperature of the gas is lower at P than at Q.

d. The temperature of the gas is higher at Q than at R.

Each week, a salesperson is paid a base salary of $250 plus $100 for each car sold. Which of the following shows information that is all correct about the salesperson's total pay for a week?

<table>
<thead>
<tr>
<th>a</th>
<th>Number of cars sold</th>
<th>Total pay ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>250</td>
<td>1k</td>
</tr>
<tr>
<td>4</td>
<td>650</td>
<td>1k</td>
</tr>
<tr>
<td>5</td>
<td>750</td>
<td>1k</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b</th>
<th>Number of cars sold</th>
<th>Total pay ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1250</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>c</th>
<th>Number of cars sold</th>
<th>Total pay ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1400</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1750</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>d</th>
<th>Number of cars sold</th>
<th>Total pay ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>650</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>750</td>
<td></td>
</tr>
</tbody>
</table>
Rita measures the height of the water in a swimming pool as it is pumped out at a constant rate.

Which graph best represents the height of the water?

a

\[ H \]

Height of water

0

Time

\[ t \]

b

\[ H \]

Height of water

0

Time

\[ t \]

c

\[ H \]

Height of water

0

Time

\[ t \]

d

\[ H \]

Height of water

0

Time

\[ t \]
Use first differences to determine which table of values shows data from a linear relationship.

a

<table>
<thead>
<tr>
<th>n</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

b

<table>
<thead>
<tr>
<th>n</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>2</td>
<td>-2</td>
</tr>
<tr>
<td>3</td>
<td>-1</td>
</tr>
<tr>
<td>4</td>
<td>-2</td>
</tr>
</tbody>
</table>

c

<table>
<thead>
<tr>
<th>n</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
</tr>
</tbody>
</table>

d

The graph below shows information about the linear relationship between the volume of water in a tank and time.

The graph shows a line with a negative slope, indicating a decrease in volume over time. The rate of change can be calculated using the formula:

\[
\frac{\text{rise}}{\text{run}} = \frac{-100}{-4} = 25
\]

What is the rate of change in this relationship?

a. \(-0.04\) L/min
b. \(-0.5\) L/min
c. \(-25\) L/min
d. \(-50\) L/min
13. The relationship between the distance below the surface and time for two scuba divers is shown by the graphs below.

Diver A
Distance Below the Surface vs. Time

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Distance below the surface (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
</tr>
<tr>
<td>4</td>
<td>32</td>
</tr>
<tr>
<td>5</td>
<td>40</td>
</tr>
</tbody>
</table>

\[ \frac{8}{1} = 8 \text{ m/min} \]

Diver B
Distance Below the Surface vs. Time

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Distance below the surface (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
</tr>
<tr>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>8</td>
<td>80</td>
</tr>
<tr>
<td>10</td>
<td>100</td>
</tr>
</tbody>
</table>

\[ \frac{20}{2} = 10 \text{ m/min} \]

How much faster is diver B diving than diver A?

a) 0 m/min  
b) 2 m/min  
c) 10 m/min  
d) 12 m/min

14. The equation \( C = 45 + 3d \) represents the relationship between total cost, \( C \), in dollars, and the number of days, \( d \).

Which of the following is true about this relationship?

a) The total cost is $48 per day.
   b) The total cost is $45 for 3 days.
   c) The total cost is made up of a $45 fixed fee and $3 per day.
   d) The total cost is made up of a $3 fixed fee and $45 per day.

15. The total cost of a cellphone plan, \( C \), in dollars, is determined by the equation

\[ C = 10 + 0.15n, \]

where \( n \) is the number of text messages sent.

If 25 text messages are sent, what is the total cost?

a) $13.75  
b) $35.15  
c) $100.00  
d) $253.75

16. Amanda has a snow-shovelling business. Advertising costs her $5 in total. She charges $15 per driveway.

Which equation represents the relationship between her profit, \( P \), and the number of driveways that she shovels, \( n \)?

a) \( P = 10n \)  
b) \( P = 20n \)  
c) \( P = 15n - 5 \)  
d) \( P = 5n - 15 \)
Last year's relationship between the total cost of producing yearbooks, $C$, and the number of yearbooks produced, $n$, is represented by the equation below.

$$C = 150 + 5n$$

This year, the initial cost is increased but the cost per yearbook is decreased.

Which graph could represent this year's relationship between total cost and the number of yearbooks?
An amusement park has two options for rides.
- All-Day Pass: The total cost is $36 for unlimited rides.
- Pay-as-You-Go: Information about the linear relationship between the total cost and the number of rides is shown on the graph.

Which of the following is a correct comparison of these two options?

a) Pay-as-You-Go is cheaper for 8 rides.  
   x

b) The All-Day Pass is always more expensive.  
   x

c) The All-Day Pass is cheaper if the number of rides taken is less than 6.  
   x

d) Pay-as-You-Go is more expensive if the number of rides taken is more than 7.
Healthy Start

A grocery store sells Healthy Start cereal in two different sized boxes as shown below.

**Large Box**

Cost: $5.25 for 480 g

What is the difference in the cost of 100 g of cereal in these two boxes? Show your work.

\[
\frac{5.25}{480} = 0.0109375 \text{ g}
\]

\[
0.0109375 \times 100 = 1.09 \text{ g}
\]

\[
0.9 - 0.98 = 0.11
\]

*The difference in cost of 100 g of cereal is 11¢ (or $0.11)*

The difference in the cost for 100 g of cereal in these two boxes is $0.11.
Banking on a Car

Juan borrows money from his mom to buy a used car.

His mom uses the equation shown below to determine the number of monthly payments Juan will make to pay her back.

\[ 1.13T = 75n + d \]

In the equation,

- \( T \) represents the total cost of the car before tax, in dollars,
- \( n \) represents the number of monthly payments and
- \( d \) represents the amount of his down payment, in dollars.

How many monthly payments will Juan have to make to pay his mom back fully for a car that costs $2000 before tax with a down payment of $535?

Show your work.

\[
\begin{align*}
1.13T &= 75n + d \\
1.13(2000) &= 75n + 535 \\
2260 &= 75n + 535 \\
2260 - 535 &= 75n \\
1725 &= 75n \\
\frac{1725}{75} &= n \\
23 &= n
\end{align*}
\]

The number of monthly payments is \( 23 \).
Jar of Pennies

Sheldon creates a pattern by placing pennies in a jar. Each day he adds twice as many pennies as he did the day before.

- On Day 1, he places 1 penny in the jar.
- On Day 2, he adds 2 more pennies, for a total of 3 pennies in the jar.
- On Day 3, he adds 4 more pennies, for a total of 7 pennies in the jar.
- On Day 4, he adds 8 more pennies to the jar.

He continues adding pennies using this pattern.

Complete the table of values with the total number of pennies in Sheldon’s jar on Days 4 and 5.

<table>
<thead>
<tr>
<th>Day</th>
<th>Total number of pennies in Sheldon’s jar</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>31</td>
</tr>
</tbody>
</table>

Is the relationship between the total number of pennies in Sheldon’s jar and the day number linear or non-linear?

Circle one: Linear [Non-linear]

Justify your answer. You may use the grid if you wish.

First differences are not the same
Cody gets a haircut. He measures the length of his hair as it grows back and discovers that it grows at a rate of 3 mm per week.

Complete the following table of values for the linear relation between the length of Cody’s hair and the number of weeks since his last haircut.

<table>
<thead>
<tr>
<th>Number of weeks since haircut</th>
<th>Length of hair (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
</tr>
</tbody>
</table>

State the rate of change and the initial value for this relationship.

Rate of change: \( \frac{3 \text{ mm}}{\text{wk}} \)  
Initial value: 1 mm

Write an equation to represent this linear relation, where \( L \) is the length of Cody’s hair, in mm, and \( n \) is the number of weeks since his haircut.

\[ L = 3n + 1 \]
Cellphone Plans

A company offers two different cellphone plans.

- Plan A: $17 per month for the cellphone, plus $0.25/min for additional talk time
- Plan B: $20 per month for the cellphone, plus $0.15/min for additional talk time
- Both plans include 200 minutes of talk time for free.

Determine the difference in total cost between the two cellphone plans for 237 minutes of talk time in one month.

Show your work.

\[
\begin{align*}
\text{(A)} & \quad C &= 17 + 0.25(37) \\
& &= 17 + 9.25 \\
& &= 26.25 \\
\end{align*}
\]

\[
\begin{align*}
\text{(B)} & \quad C &= 20 + 0.15(37) \\
& &= 20 + 5.55 \\
& &= 25.55 \\
\end{align*}
\]

Difference in cost: \(26.25 - 25.55 = 0.70\)

The difference in total cost for 237 minutes of talk time is \(0.70\).
### Picture of a Prism

Determine the volume of the rectangular prism pictured below.

Show your work.

**Hint:**
Use the Pythagorean theorem as part of your solution process.

\[ h^2 + 12^2 = 15^2 \]
\[ h^2 = 225 - 144 \]
\[ h^2 = 81 \]
\[ h = 9 \]

\[ \sqrt{V} = l \times w \times h \]
\[ V = 12 \times 4 \times 9 \]
\[ V = 432 \text{ cm}^3 \]

The volume of the rectangular prism is \( 432 \text{ cm}^3 \).
**Delightful Deck**

Ursula is building a deck. A view of the surface of the deck from above is pictured below.

![Diagram of a deck with angles labeled](image)

Complete the chart with the values of $x$ and $y$. Justify your answers using geometric properties.

<table>
<thead>
<tr>
<th>Value</th>
<th>Justification using geometric properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x = 115^\circ$</td>
<td>PLT - C pattern</td>
</tr>
<tr>
<td>$y = 25^\circ$</td>
<td>$y + 90^\circ + 65^\circ = 180^\circ$ [S1AT] $y = 180^\circ - 90^\circ - 65^\circ$ $y = 25^\circ$</td>
</tr>
</tbody>
</table>
26. Which rectangle below has the smallest perimeter?

a. 2 m
   18 m

b. 3 m
   12 m

c. 4 m
   9 m

d. 6 m
   6 m

27. Jensen is seeding his lawn. The shape of his lawn is shown in the diagram below.

Each bag of grass seed covers 310 m$^2$.
What is the minimum number of bags of seed that Jensen will need to seed his entire lawn?

a. 5
   $A = \frac{bh}{2}$
   $= 5 \times 30$
   $= 150$
   $= \frac{30 \times 30}{2}$
   $= 450$

b. 6
   $A = \frac{bh}{2}$
   $= 4 \times 30$
   $= 120$
   $= \frac{30 \times 30}{2}$
   $= 450$

c. 7
   $A = \frac{bh}{2}$
   $= 5 \times 30$
   $= 150$
   $= \frac{30 \times 30}{2}$
   $= 450$

d. 8
   $A = \frac{bh}{2}$
   $= 6 \times 30$
   $= 180$
   $= \frac{30 \times 30}{2}$
   $= 450$

Total Area
$= 150 + 120 + 150 + 180$
$= 500$

Total Area
$= 2070$

# Bags
$= 2070 \div 310 = 6.67$

28. Tennis balls have a radius of 3.5 cm.

Which of the following is closest to the volume of 2 tennis balls?

a. 88 cm$^3$
   $V = \frac{4}{3} \pi r^3$
   $= \frac{4}{3} \times 3.14 \times (3.5)^3$
   $= 179.50$

b. 180 cm$^3$
   $V = \frac{4}{3} \pi r^3$
   $= \frac{4 \times 3.14 \times 3.5^3}{3}$
   $= 359$

c. 359 cm$^3$
   $V = \frac{4}{3} \pi r^3$
   $= \frac{4 \times 3.14 \times 3.5^3}{3}$
   $= 359$

d. 1078 cm$^3$
   $V = \frac{4}{3} \pi r^3$
   $= \frac{4 \times 3.14 \times 3.5^3}{3}$
   $= 179.50$

2 tennis balls:
$179.50 \times 2 = 359$
29 The Snack Company sells popcorn in 2 different-sized boxes. Each box is in the shape of a rectangular prism.

- Box A has dimensions 10 cm by 20 cm by 24 cm.
- Box B has dimensions 12 cm by 22 cm by 20 cm.

\[ V = 12 \times 22 \times 20 = \frac{52800}{1000} = 52.8 \text{ cm}^3 \]

The price of the popcorn per cm\(^3\) is the same for both boxes, and the price of each box is determined by the total volume of popcorn it can hold.

If Box A’s price is $6.24, what is the price of Box B?

- a $5.67
- b $6.24
- c $6.86
- d $9.62

30 A regular hexagon with one side extended is shown.

What is the value of \(x\)?

- a 30°
- b 60°
- c 120°
- d 240°
Record your answers to the multiple-choice questions on the Student Answer Sheet (2014, Applied).

Please note: The format of this booklet is different from that used for the assessment. The questions themselves remain the same.
Directions

Make sure you have the following materials:

- Student Answer Sheet
- the Formula Sheet
- a pencil and an eraser
- a ruler
- a scientific or graphing calculator
- some paper for rough work for multiple-choice questions only

The diagrams in this booklet are not all drawn to scale.

Answering Multiple-Choice Questions

When answering the multiple-choice questions, be sure you use the Student Answer Sheet. The circles you will be filling in are lettered a, b, c, d.

1. Try to answer all of the multiple-choice questions. Be sure to read each question and its four answer choices carefully. Do not spend too much time on any one question.

2. To indicate your answer, use a pencil to fill in the circle completely on the Student Answer Sheet.
   Like this: ● Not like this: ✗ ✓ ☐ ☐

3. If you fill in more than one answer to a question, the question will be scored zero.

4. If you leave a question blank, the question will be scored zero.

5. Cleanly erase any answer you wish to change and fill in the circle for your new answer.

Answering Open-Response Questions

1. Do all of your work for each question (even your rough work) in the space provided for the question. Work on additional pages will not be scored.

2. Present a complete and well-organized solution to each question. Give as much information as you can.

3. Write your solutions so that they can be understood by someone who does not know your work.

4. Make sure you follow the directions on the Key Words page.
   For example, a question might ask you to “Show your work.” Read the Key Words page. It says to record all calculations and steps. So, if you sketch a graph in the process of getting to your answer, show the sketch and label it.

5. When using a calculator, write down the numbers you use and the operations you carry out.
   For example, a question might ask you to “Find the area of a circle with a radius of 7 cm.” You need to write \( A = \pi(7)^2 \) as well as the answer you get on your calculator.
Grade 9 Assessment of Mathematics
2014

Released Assessment Questions: Applied

Student Answer Sheet
Your multiple-choice answers must be entered on this sheet.
•  To indicate your answer, use a pencil to fill in the circle completely.
  Like this: ● Not like this: ☒  ☐  ☐  ☐
•  Do not fill in more than one answer to a question.
•  Do not leave a question blank.
•  Cleanly erase any answer you wish to change and fill in the circle for your new answer.

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.  Respond in booklet.
9.  Respond in booklet.
10.  a  b  c  d
11.  a  b  c  d
12.  a  b  c  d
13.  a  b  c  d
14.  a  b  c  d
15.  a  b  c  d
16.  a  b  c  d
17.  a  b  c  d
18.  a  b  c  d
19.  a  b  c  d
20.  a  b  c  d
22.  Respond in booklet.
23.  Respond in booklet.
24.  a  b  c  d
25.  a  b  c  d
26.  a  b  c  d
27.  a  b  c  d
28.  a  b  c  d
29.  a  b  c  d
30.  Respond in booklet.
31.  Respond in booklet.

End of Assessment

Print Student Name: ______________________________

Student Signature: ______________________________
1. Billy has 3 apples and 4 oranges.
   Which of the following has a ratio of apples to oranges equivalent to Billy's?
   - a) 3 apples and 8 oranges
   - b) 4 apples and 3 oranges
   - c) 8 apples and 6 oranges
   - d) 9 apples and 12 oranges

2. The ratio of the width to the height of a television screen is 16:9.
   If the height of the screen is 52 cm, which is closest to the width?
   - a) 92 cm
   - b) 87 cm
   - c) 59 cm
   - d) 29 cm

3. A store gives reward points for every dollar spent. The number of reward points varies directly with the total amount spent.
   Sofia spends $300 and receives 15 reward points.
   Juan spends $900. He receives reward points at the same rate as Sofia.
   How many more reward points will Juan receive than Sofia?
   - a) 20
   - b) 30
   - c) 60
   - d) 90

4. Each year, a school sends 50 students to a conference.
   Last year, the cost was $12.50 per student. This year, the cost per student has increased by 16%.
   What is the total cost to send 50 students to the conference this year?
   - a) $625
   - b) $633
   - c) $725
   - d) $841

5. What is the value of $x$ in the equation
   \[ 25 - \sqrt{x} = 9 \]
   - a) 4
   - b) 16
   - c) 225
   - d) 256

6. The formula for the volume of a cylinder is \( V = \pi r^2 h \), where \( r \) is the radius and \( h \) is the height.
   A cylinder has a radius of 3 cm and a height of 10 cm.
   Which of the following is closest to the volume of the cylinder?
   - a) 188 cm\(^3\)
   - b) 283 cm\(^3\)
   - c) 888 cm\(^3\)
   - d) 8882 cm\(^3\)
A formula for the relationship between a person's maximum heart rate, $H$, and the person's age, $a$, is shown below.

$$H = 217 - 0.85a$$

According to the formula, which of the following is closest to Jasmin's maximum heart rate if she is 14 years old?

- a 203
- b 205
- c 229
- d 239

$$H = 217 - 0.85(14)$$
Gina is buying 24 oranges. Two stores offer the following deals:

Store A: 12 oranges for $6.48
Store B: 5 oranges for $2.65

Gina can buy oranges individually.

How much will Gina save if she buys 24 oranges at Store B?

Show your work.

Store A: \[ \frac{24}{12} = 2 \text{ cases} \]
\[ 2 \times 6.48 = \$12.96 \]

Store B: \[ \frac{2.65}{5} = \$0.53 \]
\[ 0.53 \times 24 = \$12.72 \]

\[ 12.96 - 12.72 = \$0.24 \]

(24 \& savings)
9 Volumizer

The figure pictured below is made of a cylinder and a hemisphere.

Its volume can be determined using the following formula, in which \( r \) is the radius and \( h \) is the height of the cylinder.

\[
V = \frac{2}{3} \pi r^3 + \pi r^2 h
\]

Determine the volume of the figure.
Show your work.

\[
V = \frac{2}{3} (3.14)(3^3) + 3.14(3^2)(12)
\]

\[
= 56.52 + 339.12
\]

\[
V = 395.64 \text{ m}^3
\]
10. Five students plot their arm span and height on the graph below.

Arm Span vs. Height

<table>
<thead>
<tr>
<th>Arm span (cm)</th>
<th>Height (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>155</td>
</tr>
<tr>
<td>160</td>
<td>165</td>
</tr>
<tr>
<td>170</td>
<td>175</td>
</tr>
<tr>
<td>180</td>
<td>185</td>
</tr>
<tr>
<td>190</td>
<td>195</td>
</tr>
<tr>
<td>200</td>
<td>205</td>
</tr>
</tbody>
</table>

Which of the following describes one of these 5 students?

a. height: 166 cm; arm span: 162 cm
b. height: 170 cm; arm span: 164 cm
c. height: 180 cm; arm span: 165 cm
d. height: 195 cm; arm span: 188 cm

11. Each month, Alex’s cellphone plan costs $15, plus $0.10 per minute of use.

Which graph could represent Alex’s total monthly cost?

a. [Graph showing linear increase]

b. [Graph showing linear increase]

c. [Graph showing linear increase]

d. [Graph showing linear increase]
12 The scatter plot below shows data from an experiment.

Which of the following best represents the trend in this data?

- a line that starts at (0, 10) and ends at (1.5, 0)
- a line that starts at (0, 0) and ends at (1.6, 12)
- a curve that starts at (0, 10) and ends at (1.5, 0)
- a curve that starts at (0, 0) and ends at (1.6, 12)

13 Patterns are made using the square □.

For which of the following patterns is there a linear relationship between the number of squares in the term and the term number?

a

\[
\begin{array}{cccc}
\text{Term 1} & \text{Term 2} & \text{Term 3} & \text{Term 4} \\
\hline
\begin{array}{c}
\text{Term 1} \\
\text{Term 2} \\
\text{Term 3} \\
\text{Term 4}
\end{array}
\end{array}
\]

b

\[
\begin{array}{cccc}
\text{Term 1} & \text{Term 2} & \text{Term 3} & \text{Term 4} \\
\hline
\begin{array}{c}
\text{Term 1} \\
\text{Term 2} \\
\text{Term 3} \\
\text{Term 4}
\end{array}
\end{array}
\]

Which of the following is correct?

- a
- b
- c
- d
14. A graph representing the relationship between the amount of money in a bank account and time, in years, is shown below.

What is the rate of change for this relationship?

- **a** $200 per year
- **b** $160 per year
- **c** $150 per year
- **d** $100 per year

15. Halyna starts with $50 in her bank account, and she spends $3 per day from it. Compared to Halyna, Manny starts with $5 more in his account and spends $1 more each day.

Which of the following equations represents the amount of money remaining in Manny's account, $A$, at the end of each day, $d$?

- **a** $A = 51d$
- **b** $A = 59d$
- **c** $A = 55 - 9d$
- **d** $A = 55 - 4d$

16. The cost, $C$, in dollars, of a pizza with $n$ toppings is represented by the equation $C = 2n + 5$.

Which of the following statements is true?

- **a** The base cost of the pizza is $2, and the cost per topping is $5.
- **b** The base cost of the pizza is $5, and the cost per topping is $2.
- **c** The base cost of the pizza is $7, and the cost per topping is $2.
- **d** The base cost of the pizza is $7, and the cost per topping is $5.
17 Data in the table below is from a linear relationship.

<table>
<thead>
<tr>
<th>n</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>6</td>
<td>22</td>
</tr>
<tr>
<td>8</td>
<td>28</td>
</tr>
<tr>
<td>10</td>
<td>34</td>
</tr>
<tr>
<td>12</td>
<td>40</td>
</tr>
</tbody>
</table>

What is the value of C when n = 10?

a) 24  
b) 28  
c) 34  
d) 40

18 A movie-rental club charges a membership fee and a cost for each movie rented.

The table of values shows total costs for renting movies.

<table>
<thead>
<tr>
<th>Number of movies, n</th>
<th>Total cost, C ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
</tr>
</tbody>
</table>

Which of the following equations correctly represents this relationship?

a) $C = 4n + 8$  
b) $C = 4n + 12$  
c) $C = 2n + 10$  
d) $C = 2n + 12$

19 One night at 11 p.m., the temperature is $3.5 \, ^\circ C$. Throughout the night, the temperature drops at a constant rate of $2 \, ^\circ C$ per hour.

At this rate, when will the temperature reach $-7.5 \, ^\circ C$?

a) 4:30 a.m.  
b) 5:00 a.m.  
c) 5:30 a.m.  
d) 6:00 a.m.

20 Carla belongs to a movie subscription service. Her total monthly cost consists of a $16 fee and $1.50 per movie viewed.

Susan’s total monthly cost for a different movie subscription service has a fee that is $4 less than Carla’s, but the cost per movie viewed is the same.

Which of the following represents Susan’s total monthly cost, $C$, in dollars, where $n$ is the number of movies viewed?

a) $C = 20 + 1.5n$  
b) $C = 12 + 1.5n$  
c) $C = 13.5n$  
d) $C = 12n$
21 Warming Up

The temperature outside at 6 a.m. is 4 °C. The temperature rises by 1.5 °C every hour.

Complete the table of values for this relationship.

<table>
<thead>
<tr>
<th>Number of hours since 6 a.m.</th>
<th>Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 a.m.</td>
<td>4</td>
</tr>
<tr>
<td>7 a.m.</td>
<td>5.5</td>
</tr>
<tr>
<td>10 a.m.</td>
<td>10</td>
</tr>
<tr>
<td>12 p.m.</td>
<td>13</td>
</tr>
</tbody>
</table>

Graph the data on the grid below. Choose and label an appropriate scale for the T-axis.
22 Hot Air Balloons

A green hot air balloon is rising at a constant rate.

- After 2 minutes, it is at a height of 30 m.
- After 6 minutes, it is at a height of 75 m.

A blue hot air balloon is rising at twice the rate of the green balloon.

Determine the rate in metres per minute at which the blue balloon is rising.

Show your work. You may use the grid if you wish.
Two Tutors

Tianna and Liam both charge for tutoring. Information about Liam’s total charge for tutoring is shown on the grid below.

![Graph showing total charge vs. time spent tutoring]

Tianna’s total charge is made up of a base fee of $40, and $10 per hour of tutoring.

They both start a tutoring session at the same time one day, and they both spend the same amount of time tutoring.

If Tianna’s and Liam’s charges were the same, how many hours did they each spend tutoring?

Justify your answer.

\[
\text{Tianna: } C = 40 + 10h \quad \text{Liam: } C = 20h
\]

or \[40 + 10h = 20h\]

\[40 = 20h - 10h\]

\[40 = 10h\]

\[4 = h\]

Tianna and Liam each spent \(\frac{4}{10}\) hours tutoring.
24. A rectangular area will be enclosed on all 4 sides. Four options are shown below.

<table>
<thead>
<tr>
<th>Option</th>
<th>Area (m²)</th>
<th>Width (m)</th>
<th>Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>256</td>
<td>2</td>
<td>128</td>
</tr>
<tr>
<td>2</td>
<td>256</td>
<td>4</td>
<td>64</td>
</tr>
<tr>
<td>3</td>
<td>256</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>256</td>
<td>32</td>
<td>8</td>
</tr>
</tbody>
</table>

Which option has the smallest perimeter?

a. Option 1
b. Option 2

[Marked choice: c. Option 3]
d. Option 4

25. The diagram below represents the front view of a house.

Which is closest to the height, h, of the house?

a. 3 m
b. 7 m

[Marked choice: c. 10 m]
d. 12 m

26. The cone and cylinder pictured below have the same height and radius.

\[ V = 96 \text{ cm}^3 \]

The volume of the cone is 96 cm³.

What is the volume of the cylinder?

a. 32 cm³
b. 96 cm³

[Marked choice: c. 192 cm³]
d. 288 cm³

27. The diagram below shows a spherical globe in a cube-shaped box. The globe fits tightly in the box.

Which is closest to the volume of empty space in the box?

[Marked choice: a. 244 cm³]
28 What is the value of $y$ in the diagram below?

\[ \text{Sum} = 360^\circ \]

\[ 105 + 65 + 112 + y = 360 \]

\[ 282 + y = 360 \]

\[ y = 78 \]

a) 65°
b) 75°
c) 78°
d) 102°

29 What is the value of $x$ in the diagram below?

\[ y = 180 - 72 - 52 \]

\[ y = 56^\circ \]

\[ \text{Also} \quad x = 180 - 56 \]

\[ x = 124^\circ \]

a) 56°
b) 72°
c) 108°
d) 124°
30 Flat Shape

The shape below is made of a semicircle and a triangle.

![Diagram of a shape made of a semicircle and a triangle with dimensions 16 cm and 12 cm.]

Determine the area of this shape.

Show your work.

\[ A = \frac{bh}{2} + \frac{\pi r^2}{2} \]

\[ = \frac{16 \times 12}{2} + \frac{3.14 \times 8^2}{2} \]

\[ = 96 + 100.48 \]

\[ A = 196.48 \text{ cm}^2 \]
A sign is strung between two posts as shown below.

\[ a = 180 - 40 - 75 \]
\[ a = 65^\circ \]

Complete the table below with the values of \( x \) and \( y \).

Justify your answers using geometric properties.

<table>
<thead>
<tr>
<th>Value</th>
<th>Justification using geometric properties</th>
</tr>
</thead>
</table>
| \( x = 110^\circ \) | Sum of int. angles is 360°
\[ 360 - (75 + 95 + 80) = 360 - 250 = 110^\circ \] |
| \( y = 65^\circ \) | P.L.T = Z pattern |