Common Component

Questions on computer,
*responses completed on computer*

In this part you will:

- read 2 tasks
- complete 6 questions for each task

**Value:** 30%
**Suggested Time:** 40 minutes

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Plan and Design: Fish Traps

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Reasoned Estimates: Stopping Distances

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For thousands of years, First Nations people in British Columbia used a variety of fish traps in rivers and along the coast to catch fish. One common fishing method was the basket or cone-shaped trap with a circular opening. This trap is made of branches from red willow trees. The size of the trap would depend on the size and species of fish that people were trying to catch.
You decide to build your own fish trap using the following design:

**Fish Trap Design**

**Dimensions**

50 cm

156 cm

**Branch Spacing on Opening Ring**

5 cm

3 cm

2 cm diameter

Diagrams not drawn to scale.
1. Which of the following factors would be most important in designing a cone-shaped fish trap?

- size of fish in the river
- speed of the current in the river
- number of fish traps in the river
- height of willow trees near the river

2. Match the descriptions to the dimensions in the diagram.

**Drag and drop the letters to the boxes below.**

- Radius of trap opening
- Diameter of trap opening
- Distance between support rings
- Length of branches used for sides of the trap
3. In order to build the fish trap shown in the design, you need branches for the length of the sides of the trap and 6 additional branches for the support rings.

Which of the following expressions will calculate the number of branches required to build this trap, if \( d \) = diameter of fish trap opening?

- \( \frac{\pi d}{2} + 6 \)
- \( \frac{\pi d}{3} + 6 \)
- \( \frac{\pi d}{5} + 6 \)
- \( \frac{\pi d + 6}{3} \)

4. You consider building another, larger fish trap.

If you want to double the area of the opening of the original fish trap design, what is the required diameter?

**Record your answer, rounded to the nearest centimetre.**

\[
\begin{array}{c}
\square \ \square \ \square \\
\text{cm}
\end{array}
\]
5. The diameter of your fish trap opening should be 6 times the body depth of the fish; the length of the fish trap should be 4 times the length of the fish. The fish you intend to catch have a length to body depth ratio of 5:1, and a typical length of 55 cm.

Determine the diameter of the fish trap opening and the length needed.

**Record your answers, rounded to the nearest centimetre.**

Fish Trap Opening Diameter \[ \square \square \square \] cm

Fish Trap Length \[ \square \square \square \] cm
6. When the fish trap is propped up, fish enter, get stuck above the water level, and are unable to escape.

Complete the sentence considering the angle between the fish trap and the river bottom.

the angle will _______

the part of the fish trap that is above the water level on which fish can get trapped.

Increasing

Decreasing

decrease

increase
TOTAL STOPPING DISTANCE: distance a vehicle travels from the time the driver sees a hazard to the time vehicle is fully stopped.

REACTION TIME: time from when the driver sees a hazard to the time when they apply the brakes.
  ° typically between 1 and 2 seconds
  ° depends on factors such as driver’s age, experience, and whether the driver is tired, distracted or impaired (by alcohol, medication or drugs)

REACTION DISTANCE: distance vehicle travels during the reaction time.

BRAKING DISTANCE: distance vehicle travels from when the brakes are applied until the vehicle is fully stopped.
  ° affected by factors such as friction between the tires and road surface, condition of braking system, and condition of tires
NOTE TO AWIS: Please have a tool for students to be able to draw a vertical line or place a ruler on the graph.
7. Classify the following relationships.

**Drag and drop the terms Linear or Non-linear into the spaces provided.**

8. Which of the following occurs as a vehicle approaches 75 km/h?

**Select all that apply.**

- Reaction distance exceeds 40 m.
- Total stopping distance exceeds 60 m.
- Braking distance begins to exceed reaction distance.
- Reaction distance is approximately equal to total stopping distance.
9. Which steps could you use to estimate the total stopping distance if you are driving at 120 km/h?

Select all that apply.

☐ Extend the total stopping distance graph to 120 km/h.
☐ Add the total stopping distances at 80 km/h and 40 km/h.
☐ Multiply the sum of the braking and reaction distances at 40 km/h by 3.
☐ Extend the braking and reaction distance graphs to 120 km/h and add the values.
☐ Extend the braking distance graph to 120 km/h and subtract the reaction distance at 120 km/h.

10. If the car’s speed is doubled, how much longer is the braking distance?

Record your answer, rounded to the nearest whole number.

☐ ☐ times longer

11. Estimate the reaction distance for a car traveling at 130 km/h.

Record your answer, rounded to the nearest metre.

☐ ☐ m
12. Your friend’s car has old tires. Her driving instructor tells her that older tires have a lower braking performance than newer tires. Your friend says:

“So, my total stopping time is longer because my braking distance increases and my reaction time increases.”

Complete the driving instructor’s response to your friend.

I think my total stopping time increases because my braking distance increases and my reaction time increases.

It’s actually the stopping distance that is affected. Your braking distance decreases, stays the same, increases, your reaction distance decreases, stays the same, increases, so your total stopping distance is longer.
Student-Choice Component

Questions on computer, responses completed on pink response sheet

In this part you will:
- choose the task for which you would like to complete an extensive constructed response question
- complete the extensive constructed response question

Value: 20%  Suggested Time: 20 minutes

Think carefully; once you make your choice you must complete this question.

Plan and Design: Fish Traps
Design and draw a fish trap using given criteria.

Reasoned Estimates: Stopping Distances
Use data to estimate the stopping distance for a vehicle under certain conditions.
You have chosen:

**Fish Traps**

Design and draw a fish trap using given criteria.
13. **Answer this question on the pink sheet.**

You would like to build a cone-shaped fish trap, and have noted the following criteria.

- The fish you wish to trap can be up to 30 cm long.
- The trap should be 4 times longer than the fish you wish to trap.
- The ratio of length to body depth of these fish is typically 5:1.
- The diameter of the trap opening should be 6 times the body depth of the fish you wish to trap.
- The branches that form the length of the trap are 2 cm in diameter and have a 3 cm gap between them at the trap opening.
- Support rings are required every 8 cm along the length of the trap.

Design a fish trap with these criteria in mind. Draw your design, including dimensions, and identify the number of branches you would need for each part of the trap.

Explain and justify your solution. Be sure to include any calculations, estimations, and any assumptions you made.
You have chosen:

**Stopping Distances**

Use data to estimate the stopping distance for a vehicle under certain conditions.
13. **Answer this question on the pink sheet.**

Using the tables, estimate the reaction distance, braking distance, and total stopping distance, in wet and dry conditions, for cars travelling at 130 km/h.

How much further would the car travel while stopping in wet conditions?

Explain and justify your solution. Be sure to include any calculations, estimations, and assumptions you made.

### Reaction, Braking and Total Stopping Distances on a Dry Road for a Typical Car

<table>
<thead>
<tr>
<th>Speed (km/h)</th>
<th>Reaction Distance (m)</th>
<th>Braking Distance (m)</th>
<th>Total Stopping Distance (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>17</td>
<td>9</td>
<td>26</td>
</tr>
<tr>
<td>50</td>
<td>21</td>
<td>14</td>
<td>35</td>
</tr>
<tr>
<td>60</td>
<td>25</td>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>70</td>
<td>29</td>
<td>27</td>
<td>56</td>
</tr>
<tr>
<td>80</td>
<td>33</td>
<td>36</td>
<td>69</td>
</tr>
<tr>
<td>90</td>
<td>37</td>
<td>45</td>
<td>83</td>
</tr>
<tr>
<td>100</td>
<td>41</td>
<td>56</td>
<td>98</td>
</tr>
<tr>
<td>110</td>
<td>45</td>
<td>67</td>
<td>113</td>
</tr>
</tbody>
</table>

### Reaction, Braking and Total Stopping Distances on a Wet Road for a Typical Car

<table>
<thead>
<tr>
<th>Speed (km/h)</th>
<th>Reaction Distance (m)</th>
<th>Braking Distance (m)</th>
<th>Total Stopping Distance (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>17</td>
<td>13</td>
<td>30</td>
</tr>
<tr>
<td>50</td>
<td>21</td>
<td>20</td>
<td>41</td>
</tr>
<tr>
<td>60</td>
<td>25</td>
<td>29</td>
<td>54</td>
</tr>
<tr>
<td>70</td>
<td>29</td>
<td>40</td>
<td>69</td>
</tr>
<tr>
<td>80</td>
<td>33</td>
<td>52</td>
<td>85</td>
</tr>
<tr>
<td>90</td>
<td>37</td>
<td>65</td>
<td>103</td>
</tr>
<tr>
<td>100</td>
<td>41</td>
<td>80</td>
<td>122</td>
</tr>
<tr>
<td>110</td>
<td>45</td>
<td>97</td>
<td>143</td>
</tr>
</tbody>
</table>
Common Component

Questions on computer, **responses completed on computer**

In this part you will:

- read 2 tasks
- complete 6 questions for each task

**Value:** 30%

**Suggested Time:** 40 minutes
Lynx sightings increasing

Lynx rely almost entirely on snowshoe hare as their main food source. Each lynx eats approximately 2 snowshoe hare every 3 days. Over the years, both populations have risen and fallen. The relationship between the snowshoe hare population and the lynx population has been documented for over 200 years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Snowshoe Hare Population (x 1000)</th>
<th>Lynx Population (x 1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1901</td>
<td>47</td>
<td>6</td>
</tr>
<tr>
<td>1903</td>
<td>77</td>
<td>35</td>
</tr>
<tr>
<td>1905</td>
<td>21</td>
<td>42</td>
</tr>
<tr>
<td>1907</td>
<td>21</td>
<td>13</td>
</tr>
<tr>
<td>1909</td>
<td>25</td>
<td>9</td>
</tr>
<tr>
<td>1911</td>
<td>40</td>
<td>8</td>
</tr>
<tr>
<td>1913</td>
<td>77</td>
<td>20</td>
</tr>
<tr>
<td>1915</td>
<td>20</td>
<td>51</td>
</tr>
<tr>
<td>1917</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>1919</td>
<td>16</td>
<td>10</td>
</tr>
</tbody>
</table>
14. In which of the following years did the snowshoe hare population peak?

Highlight all that apply.

- 1901
- 1903
- 1905
- 1907
- 1909
- 1911
- 1913
- 1915
- 1917
- 1919

15. Which of the following statements are true?

Select all that apply.

- In 1913 there were 20 lynx.
- The snowshoe hare population has approximately a ten-year cycle.
- The snowshoe hare population is always greater than the lynx population.
- The lynx population peaks about 5 years after the peak of the snowshoe hare population.
- There are times when there are approximately equal numbers of snowshoe hare and lynx.
16. A biologist started tracking the number of lynx in the Yukon. They recorded the population every 3 years as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Lynx</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>11 000</td>
</tr>
<tr>
<td>3</td>
<td>28 000</td>
</tr>
<tr>
<td>6</td>
<td>42 000</td>
</tr>
<tr>
<td>9</td>
<td>5 000</td>
</tr>
<tr>
<td>12</td>
<td>18 000</td>
</tr>
<tr>
<td>15</td>
<td>40 000</td>
</tr>
</tbody>
</table>

Create an equation to calculate the percent decline in the lynx population between years 6 and 9.

**Drag and drop the operations and numbers into the boxes below.**

\[
\text{42 000} \quad \text{5000} \quad + \quad - \quad \times \quad \div
\]

\[
\text{\% decline} = \frac{\text{\underline{42 000}}} {\text{\underline{5 000}}} \times 100
\]

17. From 1901 to 1919, what was the highest ratio of snowshoe hare to lynx that occurred?

**Answer to the nearest whole number.**

\[
\underline{\underline{4 \quad : \quad 1}}
\]
18. Approximately how many snowshoe hare does one lynx eat in a year?

- 120
- 240
- 550
- 730

19. Assume the trends shown in the graph from 1901 to 1919 continue.

Complete the following statements for the years 1919 to 1921.

The number of lynx will [decrease, increase]. The number of snowshoe hare will [decrease, stay the same, increase].

The number of snowshoe hare will be [fewer than, equal to, more than] the number of lynx.
You are planning to move into a 3-bedroom apartment with two roommates. The floor plan for the apartment is below.

Total Apartment Area: 118.96 m²

You and your roommates agree that all space in the apartment other than bedrooms will be common area shared by all.
In this apartment, the cost of utilities (electricity, internet) is paid by the renters. You and your roommates decide to divide the rent and utilities. Food costs will be handled individually.

You create a spreadsheet to help in budget planning and calculating the size of each of the bedrooms:

### Budget Planning

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td><strong>Expense</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td><strong>Cost per Month ($)</strong></td>
<td><strong>Cost per Person ($)</strong></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Rent</td>
<td>1200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Electricity</td>
<td>110</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Internet</td>
<td>130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Total</td>
<td>1440</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td><strong>Size of Bedrooms</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td><strong>Length (m)</strong></td>
<td><strong>Width (m)</strong></td>
<td><strong>Area (m²)</strong></td>
</tr>
<tr>
<td>11</td>
<td>Bedroom 1</td>
<td>4.50</td>
<td>2.18</td>
<td>9.81</td>
</tr>
<tr>
<td>12</td>
<td>Bedroom 2</td>
<td>4.50</td>
<td>3.68</td>
<td>16.56</td>
</tr>
<tr>
<td>13</td>
<td>Bedroom 3</td>
<td>3.88</td>
<td>3.61</td>
<td>14.01</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
20. What information do you need in order to divide the monthly expenses so that each roommate pays an equal amount?

Select all that apply.

☐ size of bedrooms
☐ days in each month
☐ number of roommates
☐ total cost of shared expenses

21. The first month’s rent includes a damage deposit. The damage deposit is equal to half of one month’s rent. This deposit is returned to the renters at the end of the rental agreement if the apartment is in good condition.

If costs are shared equally, which of the following represents the cost of rent and utilities for each roommate for the entire first year?

☐ \( \frac{1200 \times 12}{3} + 600 \)

☐ \( \frac{(1200 \times 1.5) \times 12}{3} \)

☐ \( \frac{(1200 \times 1.5 + 110 + 130) \times 12}{3} \)

☐ \( \frac{[(1200 + 110 + 130) \times 12] + 600}{3} \)
22. There are several ways of comparing the areas of the largest and smallest bedrooms.

**Drag and drop each term to the expression it best describes.**

\[
\begin{align*}
&\frac{16.56}{9.81} \quad \text{Difference} \\
&\frac{16.56 - 9.81}{16.56} \times 100 \quad \text{Percentage Difference} \\
&\frac{16.56}{9.81} \times 100 \quad \text{Ratio} \\
&16.56 - 9.81 \quad \text{Percentage}
\end{align*}
\]

23. Using only whole numbers, approximate the ratio of common area to total bedroom area in the apartment.

\[
\square : \square
\]

24. It is decided that you will have Bedroom 1.

If the monthly rent of $1200 was divided based on bedroom area, what would be your share of the rent?

**Record your answer, rounded to the nearest dollar.**

\[
\$\square \square \square
\]
25. Which of the following would be valid reasons for having some roommates pay a larger share of the costs than others?

Select all that apply.

- [ ] No one uses the storage room.
- [ ] The bedrooms are different sizes.
- [ ] One roommate spends more money on food.
- [ ] One roommate works from home and has taken over the den for their office space.
- [ ] Roommate in Bedroom 3 has taken over the bathroom near their bedroom for their own personal use.
In this part you will:

- choose the task for which you would like to complete an extensive constructed response question
- complete the extensive constructed response question

**Value:** 20%  **Suggested Time:** 20 minutes

Think carefully; once you make your choice you must complete this question.

**Model:** Snowshoe Hare and Lynx

Use a graph to predict the peak hare and lynx populations.

**Fair Share:** Roommates

Propose a fair way to divide the rent and utilities among roommates.
You have chosen:

**Snowshoe Hare and Lynx**

Use a graph to predict the peak hare and lynx populations.
26. **Answer this question on the yellow sheet.**

The relationship between the numbers of snowshoe hare and lynx is tightly linked, as the snowshoe hare make up over 95% of the diet of the lynx. The graph shows the cyclical nature of this relationship.

Biologists have noted a recent decline in the numbers of snowshoe hare and lynx at the peak of their cycles. They are estimating a similar percentage decrease in the next cycle as well.

Using the information in the graph above, predict the peak populations of each species in their next cycle. Create a graph starting at year 16 showing population numbers and the time (year) when these peaks will occur.

Explain and justify your solution. Be sure to include any calculations, estimations, and assumptions you made.
Propose a fair way to divide the rent and utilities among roommates.
26. **Answer this question on the yellow sheet.**

You have Bedroom 1, Taylor has Bedroom 2, and Pat has Bedroom 3. Pat requests to use the den as an office space. Taylor will only be home 4 days a week for the next 6 months.

Considering this, propose a fair way to divide the monthly rent and utilities of this apartment for the 6 months.

Explain and justify your solution. Be sure to include any calculations, estimations, and any assumptions you made.