GRADE 12 ESSENTIAL

UNIT A – PROBLEM SOLVING, GAMES AND NUMBERS

PROBLEM SOLVING WORKBOOK

Do this workbook on your own time. It is not marked. But it will be very useful for occasional questions on quizzes and tests and exams.

Notice the 10 Strategies:

Use Multiple Steps; Draw a picture; Look for a Pattern; Guess and Check; Identify Missing Info; Make a list; Solve a Simpler Version; Wok Backward; Use Estimation; Use A Formula; Use Logic

(and combinations of all of these)

NAME _____

PROBLEM-SOLVING STRATEGIES

Multi-Step

Sometimes it takes **multiple steps** to solve problems.

A wooden fence is to be built around a 30-m by 50-m garden. If the wood for the fence costs $36.95 per metre, how much will the wood for the entire fence cost?

The total distance around the garden is 160 m.

It will cost $5912 to fence the garden.

Find the total number of metres of fencing needed.

30 + 30 + 50 + 50 = 160

Next, find the total cost of fencing that distance.

160 × $36.95 = $5912

Solve each problem.

SHOW YOUR WORK

1. On her first five science tests, Maria scored the following: 92, 86, 78, 94, and 95. What must she score on the sixth test so that her average for all six marks is 1 point higher than her average is right now?

   Maria has a total of _____ points on her first five tests.

   One point higher than her average on the first five tests is _____.

   Maria needs a total of _____ points on all six tests.

   Maria must score a(n) _____ on her sixth test.

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2. A carpet cleaning company has eight homeowners that want their carpets cleaned. It takes one worker 12 h per home to clean a house full of carpet. If a team of three workers is assigned to each house, how many hours will it take to clean all eight homes?

   Three workers can clean one house in _____ h.

   The carpet cleaning company can have the carpet in all eight homes cleaned in _____ h.

NAME _____

PROBLEM-SOLVING STRATEGIES

Draw a Picture

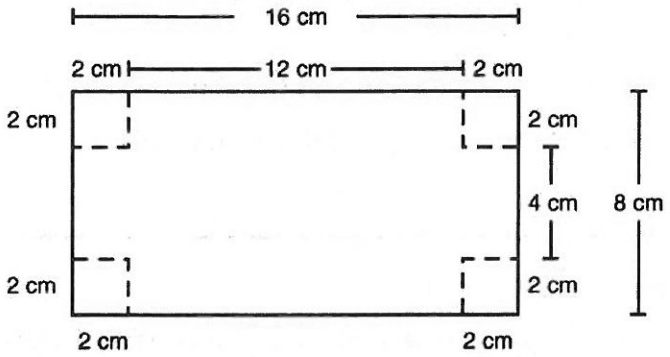
Sometimes you can **draw a picture** to solve problems.

A rectangular piece of cardboard is 8 cm wide and 16 cm long. Squares measuring 2 cm on each side are cut from each corner of the cardboard. Then, the sides of the cardboard are folded to make a box. What is the volume of the box?

After cutting a 2-cm square from each corner and folding the cardboard into a box, the new width is 4 cm, and the new length is 12 cm. The height of the box is 2 cm.

The volume of the box is 96 cm^3.

Draw a picture of the rectangular cardboard with squares cut from the corners.



Then find the volume.

V = length × width × height

$V = 12 \times 4 \times 2$

$= 96$

Draw a picture to solve each problem.

SHOW YOUR WORK

1. A baseball diamond can be described as a square that measures about 27 m on each side. What is the perimeter of a square whose sides are drawn inside the baseball diamond at a distance of 1 m from the baselines?

   Each side of the inner square is _____ m long.

   The perimeter of the inner square is _____ m.

---

2. Mr. Story designed a flag that is 250 cm by 375 cm. After the flag was completed, he decided to attach 15-cm-long fringe around the edges of the flag. What are the dimensions of the flag including the fringe?

   With the fringe attached, the flag has a width of _____ cm and a length of _____ cm.

NAME _____

PROBLEM-SOLVING STRATEGIES

Look for a Pattern

Sometimes you must **look for a pattern** to solve problems.

Jordan designed the following pattern.

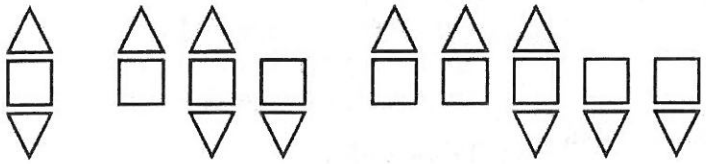


Fig. 1 Fig. 2 Fig. 3

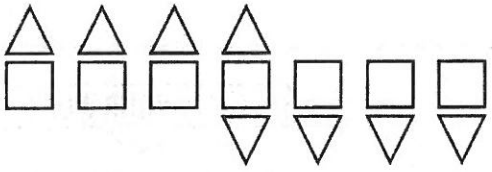
What will the next figure in his pattern look like?

The number of triangles on the bottom of each figure increases by 1.

The number of triangles on the top of each figure increases by 1.

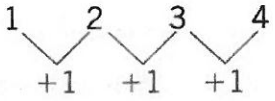
The number of squares in each figure increases by 2.

The next figure in Jordan's pattern will look like this:

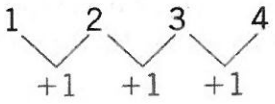


Look for a pattern.

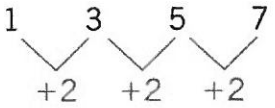
Number of triangles on bottom:



Number of triangles on top:



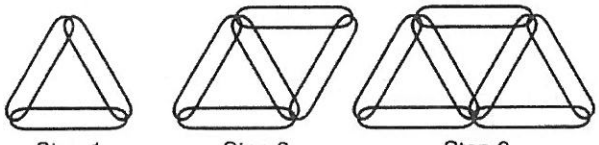
Number of squares:



Solve each problem.

SHOW YOUR WORK

1. Brianne designs jewellery. Below are three of the five steps she followed in making a silver barrette from links.



Step 1 Step 2 Step 3

How many links did Brianne use to make the barrette?

Step 1 uses _____ silver links.

Step 2 uses _____ silver links.

Step 3 uses _____ silver links.

After finishing step 5, Brianne used _____ silver links.

NAME _____

PROBLEM-SOLVING STRATEGIES

Guess and Check

Sometimes you must **guess and check** to solve problems.

Roberto used an equal number of quarters, dimes, and nickels to buy a $2.00 greeting card. How many of each coin did he use?

Guess possible numbers of each coin.

Check to see if the value of the number of coins is $2.00.

Roberto used five quarters, five dimes, and five nickels to buy a $2.00 greeting card.

Guess: 4 quarters, 4 dimes, and 4 nickels
Value: $0.25 × 4 = $1.00
$0.10 × 4 = $0.40
$0.05 × 4 = $0.20

Total Value:
$1.00 + 0.40 + 0.20 = $1.60
Incorrect guess.

Guess: 5 quarters, 5 dimes, and 5 nickels
Value: 5 × $0.25 = $1.25
5 × $0.10 = $0.50
5 × $0.05 = $0.25

Total Value:

$1.25 + 0.50 + 0.25 = $2.00
Correct guess.

Guess and check to solve each problem.

SHOW YOUR WORK

1. The volume of a rectangular box is 693 cm^3. The length of the box is 2 cm more than the width, and the width is 2 cm more than the height. What are the dimensions of the box?

   The dimensions of the box are _____ cm, _____ cm, and _____ cm.

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2. Leanne drew an isosceles triangle with one angle twice the size of the sum of the other two angles. What is the size of the largest angle in Leanne's triangle? Hint: The sum of the angles in a triangle is 180°.

   An isosceles triangle has _____ equal angles.

   The largest angle measures _____ degrees.

NAME _____

PROBLEM-SOLVING STRATEGIES

Identify Missing Information

Sometimes there is **not enough information** to solve the problem.

On a map, Shelly used a ruler to determine the distance from her town to her grandmother's town. She measured the distance as 5 cm. How many metres is Shelly's town from her grandmother's town?

Not enough information

Missing information: how many kilometres 1 cm represents on the map

Use a proportion to determine the number of actual kilometres equivalent to 5 cm on the map.

$$\frac{1\text{ cm}}{?\text{ km}} = \frac{5\text{ cm}}{?\text{ km}}$$

Information on how many kilometres on the map each centimetre represents is missing.

Identify the missing information in each problem.

SHOW YOUR WORK

1. Last softball season, the Jets won nine of the games they played. What percent of games played did they win?

   _____

   Missing information: _____

   _____

---

2. Carl leaves home at 7:30 A.M. to travel to the lake where he has a summer job. If he drives at an average rate of 70 km/h, when will he arrive at the lake?

   _____

   Missing information: _____

   _____

NAME _____

PROBLEM-SOLVING STRATEGIES

Make a Table

Sometimes you can **make a table** to solve problems.

Archie mows Mr. Chun's lawn every third day. Every Monday and Thursday he has trumpet lessons. Every fourth day Archie helps his grandfather repair clocks. If he does all three activities on Monday, June 1, when is the next date that he will do all three activities?

Archie does all three activities again on June 25.

Make a table to determine what date Archie does all three activities.

Mon	Tues	Wed	Thurs	Fri	Sat	Sun
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	○ = mow / = repair clocks \ = trumpet lessons				

Make a table to solve each problem.

SHOW YOUR WORK

1. Marshal puts $2 into his savings account every 3 days. Karen puts $3 into her savings account every 4 days. They both began their savings account on Monday, September 1. At the end of 30 days, how much money will they each have in savings?

   After 30 days, Marshal will have _____ in his savings account.

   After 30 days, Karen will have _____ in her savings account.

---

2. At a store's grand opening, every third person entering the store wins a $5 gift certificate. Every fifth person wins a free ice-cream cone. Out of 30 people, how many people will get both a $5 gift certificate and an ice-cream cone?

   Out of 30 people, _____ people will get both a $5 gift certificate and an ice-cream cone.

NAME _____

PROBLEM-SOLVING STRATEGIES

Make a List

Sometimes you can **make a list** to solve problems.

There is a certain town called Quatreville where every family has exactly four children. In how many different orders of birth can boys and girls be born into the families in Quatreville?

There are 16 possible orders of birth in Quatreville.

Make a list of all possible combinations. Let B stand for boy and G stand for girl. Start by listing the oldest child first.

4 boys	3 boys	2 boys	1 boy	0 boys
BBBB	BBBG	BBGG	BGGG	GGGG
	BBGB	BGBG	GBGG	
	BGBB	BGGB	GGBG	
	GBBB	GBGB	GGGB	
		GBBG		
		GGBB		

Count the combinations in each column.

1 4 6 4 1

Make a list to solve each problem.

SHOW YOUR WORK

1. A vending machine at Riley's school sells yogourt cups that cost $0.55. The machine accepts only loonies or correct change. It only gives nickels, dimes, and quarters for change. How many different combinations of nickels, dimes, and quarters could it give?

   The machine must give _____ in change when a loonie is used.

   There are _____ different combinations that the machine can give change in quarters, dimes, and nickels.

---

2. Two number cubes, one numbered 1 to 6, one numbered 7 to 12, are tossed. How many different ways are there to get a sum of 14?

   There are _____ different ways to make a sum of 14 when rolling the two number cubes.

NAME _____

PROBLEM-SOLVING STRATEGIES

Solve a Simpler Problem

Sometimes you can **solve a simpler problem** to solve problems.

Motega is helping the scouts with a project. He needs to cut a 200-cm length of wire into 1-cm pieces. How many cuts will he have to make?

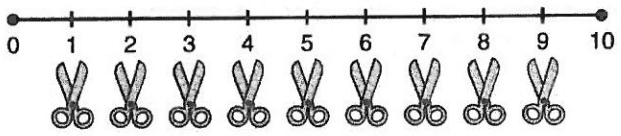
Motega would need to make 1 cut in a 2-cm length of wire.

Motega would need to make 5 cuts in a 6-cm length of wire.

Motega would need to make 9 cuts in a 10-cm length of wire.

Motega would need to make 199 cuts in a 200-cm length of wire.

Solve a simpler problem. Determine how many cuts Motega will need to cut in a smaller length of wire.



Solve a simpler problem to solve each problem.

SHOW YOUR WORK

1. For its fundraiser, the soccer team sold raffle tickets. The tickets were numbered in order. The first ticket Jorge sold was numbered 299 and the last ticket he sold was numbered 355. How many tickets did Jorge sell?

   Jorge sold _____ tickets.

---

2. Alma and her family are going to plant 28 fir trees around a square lot. They want to plant one tree at each corner and then space the remaining trees 3 m apart around the perimeter of the lot. What is the area of the lot?

   If 4 trees are planted, the lot has
   _____ × _____ = _____ m^2.

   If 8 trees are planted, the lot has
   _____ × _____ = _____ m^2.

   If 12 trees are planted, the lot has
   _____ × _____ = _____ m^2.

   If 28 trees are planted, the lot has
   _____ × _____ = _____ m^2.

NAME _____

PROBLEM-SOLVING STRATEGIES

Work Backward

Sometimes you can **work backward** to solve problems.

A company that made a very good profit this year gave half to a local charity. They gave an overseas charity half of the remaining money and kept $3.4 billion. How much profit did the company have this year?

The company had a profit of $13.6 billion this year.

Work backward.

Before they gave half to an overseas charity:
$3.4 billion + $3.4 billion
= $6.8 billion

Before they gave half to a local charity:
$6.8 billion + $6.8 billion
= $13.6 billion

Work backward to solve each problem.

SHOW YOUR WORK

1. Michael cashed his paycheque. He spent half his pay on new clothes. He spent a third of what he had left on a gift for his mother. He put the remaining $25 in his savings account. How much was Michael's paycheque worth?

   Michael's paycheque was worth $_____.

---

2. After deductions, LaToya's paycheque for 40 h of work was worth $372. She paid $68 in provincial taxes, $18 in federal taxes, and $42 in city taxes. How much does LaToya get paid per hour?

   LaToya earned $_____ before deductions.

   LaToya is paid $_____ per hour.

---

3. Building A is 3.5 m taller than Building B.
   Building B is 2.5 m taller than Building D.
   Building D is 15 m taller than Building C.
   Building C is 37 m tall. How tall is Building A?

   Building A is _____ m tall.

NAME _____

PROBLEM-SOLVING STRATEGIES

Use Estimation

Sometimes you can **use estimation** to solve problems.

When Tamoko visited Mexico, $1 in Canadian money could be exchanged for 6.875 pesos. If Tamoko exchanged $95 in Canadian money, about how many pesos should she receive?

Tamoko should receive about 700 pesos.

Estimate. Round 6.875 pesos to 7 and 95 to 100, then multiply.

$7 \times 100 = 700$ pesos

Use estimation to solve each problem.

SHOW YOUR WORK

1. A 400-g box of Corn Frosties costs $3.79. Another brand, Sugared Corn Flakes, costs $4.99 for a 600-g box. Which cereal costs less per gram? About how much less per gram does it cost?

   _____ costs less per gram.

   It costs about _____ less per gram.

---

2. When Leona went to Japan, $1 in Canadian money could be exchanged for 91.845 yen. If Leona exchanged $45 in Canadian money, about how many yen should she have received?

   Leona should have received about _____ yen.

---

3. A 675-g jar of Best spaghetti sauce costs $3.59. Another brand, Better spaghetti sauce, costs $4.89 for a 950-g jar. Which brand of spaghetti sauce costs less per gram? About how much less per gram does it cost?

   _____ spaghetti sauce costs less per gram.

   It costs about _____ less per gram.

NAME _____

PROBLEM-SOLVING STRATEGIES

Use a Formula

You can **use a formula** to help solve problems.

A formula for the number of apples in a box is $N = S^3$, where S is the number of apples along each side of the box. Find N when there are 11 apples along one side of the box.

There are 1331 apples in this box.

Use the formula given to find the number of apples in the box.

$N = S^3$ or $S \times S \times S$

$N = 11 \times 11 \times 11$

$= 1331$

Use a formula to solve each problem.

SHOW YOUR WORK

1. Kyle uses the formula $C = 15x + 25y$ to find the cost C, in cents, of x oranges and y apples. How much would Kyle pay for 9 oranges and 7 apples?

   Kyle would pay _____ for 9 oranges and 7 apples.

---

2. A box has a volume of 240 cm^3. The height of the box is 3 cm and the width of the box is 5 cm. What is the length of the box?

   The formula for the volume of a box is _____.

   The length of the box is _____ cm.

---

3. Using $\pi \doteq 3.14$, find the volume of a cylindrical tank having a diameter of 14 m and a height of 10 m.

   The cylindrical tank has a volume of about _____ m^3.

NAME _____

PROBLEM-SOLVING STRATEGIES

Use Logical Reasoning

You can **use logical reasoning** to help solve problems.

Ann, Seung, Yolanda, and Denny each have a pet. They each have a different pet: a beagle, a cat, an angelfish, and a gerbil. Yolanda lives next door to the person with the gerbil. Denny and Seung have pets that live in small habitats. Ann cannot have a dog because of allergies. Seung is afraid of animals that bite. Which animal does each person own?

Ann has a(n) cat.

Seung has a(n) angelfish.

Yolanda has a(n) beagle.

Denny has a(n) gerbil.

Use a table to keep track of the facts. Then, indicate your conclusions.

	Beagle	Cat	Angel-fish	Gerbil
Ann	no	yes	no	no
Seung	no	no	yes	no
Yolanda	yes	no	no	no
Denny	no	no	no	yes

Use logical reasoning to help solve each problem.

SHOW YOUR WORK

1. Jarod, Scott, and Rick each ate either a hamburger, cheeseburger, or a cheese pizza for lunch. Rick did not have any meat for lunch. Jarod does not like cheese. What did each person eat for lunch?

   Jarod ate the _____.

   Scott ate the _____.

   Rick ate the _____.

---

2. Four letters, A, B, C, and D, are each written with a number, 1, 3, 5, or 8, though not necessarily in that order. The letter A is written with a prime number. The letter B is written with a number less than 5. Neither A nor D is written with a number that is an odd factor of 40. What numbers are the letters B and D written with?

   Letter B is written with the number _____.

   Letter D is written with the number _____.