Grade 7

NUMBER SENSE AND NUMERATION: INTEGERS – GRAPHICAL REPRESENTATION

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Play **Space Coupe** *http://pbskids.org/cyberchase/games/negativenumbers* and
One False Move *www.funbrain.com/ofm/index.html* (Easy/Medium Levels) first.
You may also go to *www.wiredmath.ca* for the link.

1. Write an integer to represent each statement.
   a. A loss of $5.
   b. An increase of 15 km/h.
   c. In golf Lori Kane shot 4 under par.
   d. The sixth floor above ground level.
   e. The temperature is 12°C below zero.
   f. The population increased by 4800 people last year.

2. Explain what you could do to undo your action in the form of an appropriate integer.
   a. You walk left 4 km.
   b. You climb up 10 m.
   c. You have a debt of $60.
   d. An elevator moves up 6 floors.

3. Discuss each of the following statements with a partner.
   a. The sum of two negative integers is a negative integer.
   b. The sum of any integer and its opposite is 0.
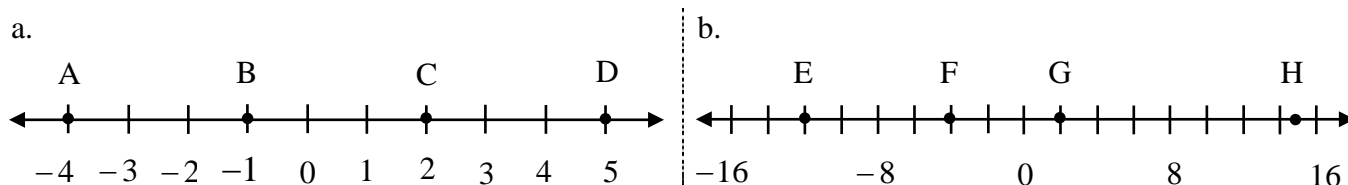   c. The number of integers from -3 to $+3$ inclusive is 7.

> **A Slice of History**
>
> The noun, integer, was first used in 1571 by an English astronomer, Thomas Diggers.
>
> It appeared in the book "**A geometrical practise named Pantometria**" which Thomas completed on behalf of his late father Leonard.

4. Write an integer that corresponds to each of the following letters.

   a.   b.

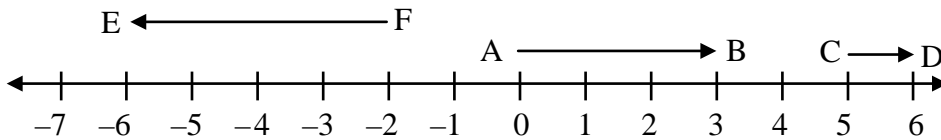   A _____   B _____   C_____   D_____   E_____   F _____   G _____   H _____

5. Arrange these integers from least to greatest.

   a. $3, -1, -4, 0$

   b. $8, -3, 4, -1, -5$

   c. $-2, 9, -8, 0, +3, -5$

   _____   _____   _____

Expectations: i) represent, compare order integers (e.g. on a number line); ii) add and subtract integers, using a variety of tools (e.g. number lines).
For more activities and resources from the University of Waterloo's Faculty of Mathematics, please visit www.cemc.uwaterloo.ca.

1

Graphical Representation – Addition

Integers represented by Arrows

[*Negative integers point to the left. Positive integers point right.*]

```
E ←———————————— F                    A ——————————→ B      C ——→ D
◄——+——+——+——+——+——+——+——+——+——+——+——+——+——+——►
  −7  −6  −5  −4  −3  −2  −1   0   1   2   3   4   5   6
```

AB with an arrowhead at B is used to show the direction in which the distance is measured.

The arrow AB represents the integer $+3$ because its direction is to the right and its length is 3.

Similarly, the arrow CD represents the integer $+1$.

FE can be represented by the integer -4 because its direction is to the left and its length is 4.

6.   In the diagram below
   a.   Name each arrow and the integer that it represents.
   b.   Write the addition expression, using integers, for the arrows AB and CD.
   c.   Write the addition expression, using integers, for the arrows HG and JI.
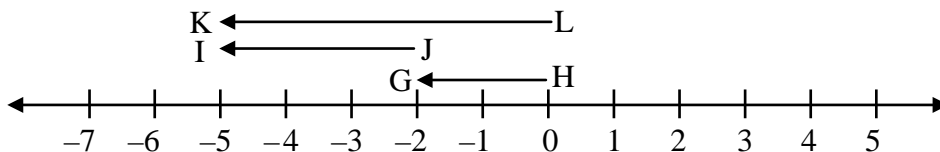
The answer is drawn from the position where you began to the position where you end. EF *and* LK *are the answers for parts b and c.*
   d.   Write an equation, using integers, for the arrows AB, CD and EF.
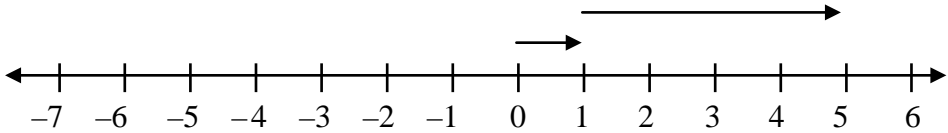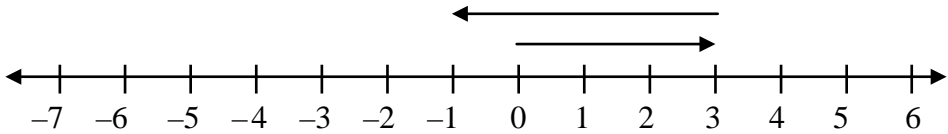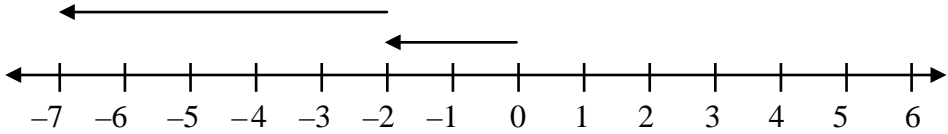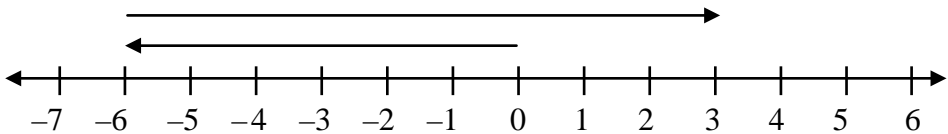   e.   Write an equation, using integers, for the arrows HG, JI and LK.

i.
```
                              E ————————————————→ F
                                          C ——→ D
                              A ——————————→ B
◄——+——+——+——+——+——+——+——+——+——+——+——+——►
  −7  −6  −5  −4  −3  −2  −1   0   1   2   3   4   5
```

ii.
```
        K ←——————————————— L
        I ←——————————— J
              G ←————— H
◄——+——+——+——+——+——+——+——+——+——+——+——+——►
  −7  −6  −5  −4  −3  −2  −1   0   1   2   3   4   5
```
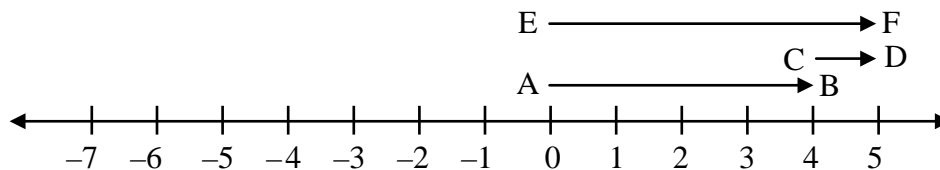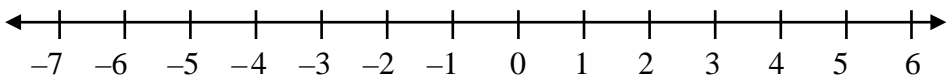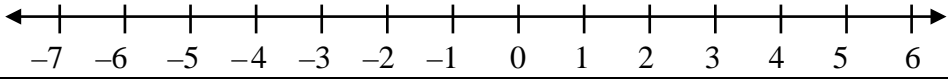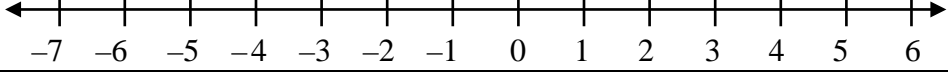
Did You Know?
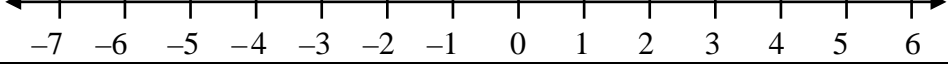
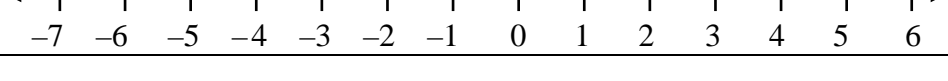There is no smallest or biggest integer!

The set of integers goes on infinitely for both directions.

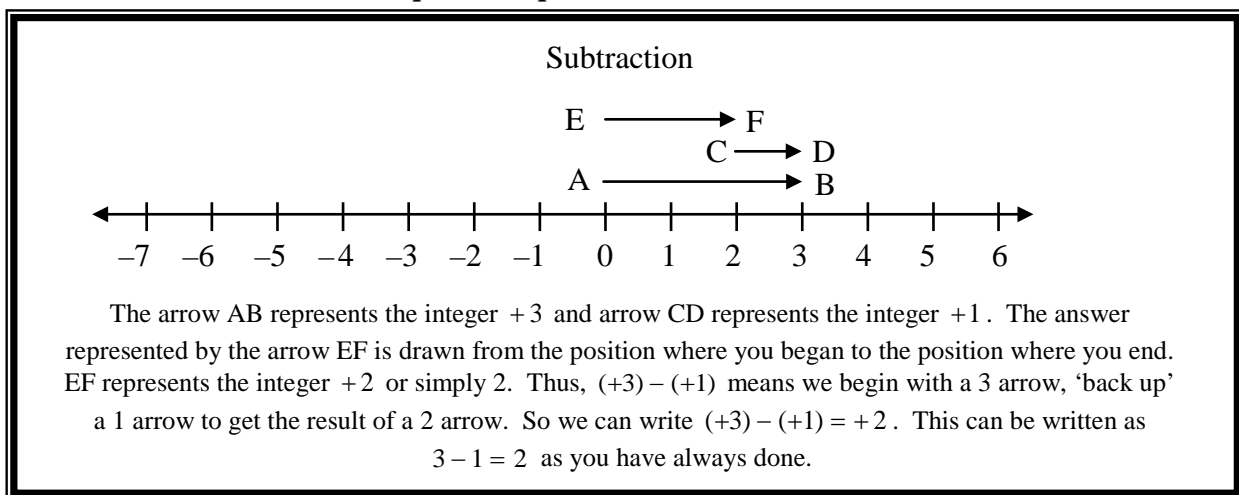$$\{..., -5, -4, -3, -2, -1, 0, +1, +2, +3, +4, +5, ...\}$$

7. Write the mathematical expression represented by the graphical representation on each number line and determine its sum.

i. ( ) + ( ) =	
ii.	
iii.	
iv.	

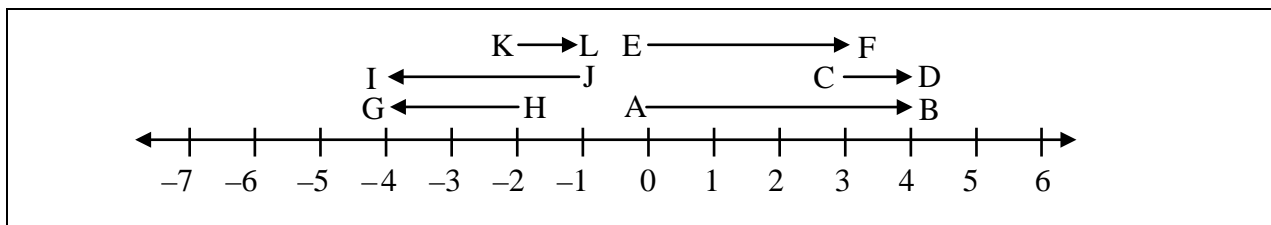8. Use a number line to illustrate each sum using a graphical representation and draw an arrow to represent the sum. **[*The answer is drawn from the position where you began to the position where you end.*]** Also, find its sum.

i. $(+2) + (+3)$ =	
ii. $(+5) + (-3)$ =	
iii. $(+2) + (-3)$ =	
iv. $(-3) + (+6)$ =	
v. $(-1) + (-4)$ =	
vi. $(-3) + (-3)$ =	

Graphical Representation - Subtraction

Subtraction

The arrow AB represents the integer $+3$ and arrow CD represents the integer $+1$. The answer represented by the arrow EF is drawn from the position where you began to the position where you end. EF represents the integer $+2$ or simply 2. Thus, $(+3) - (+1)$ means we begin with a 3 arrow, 'back up' a 1 arrow to get the result of a 2 arrow. So we can write $(+3) - (+1) = +2$. This can be written as $3 - 1 = 2$ as you have always done.
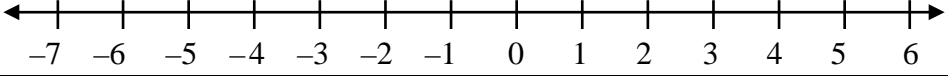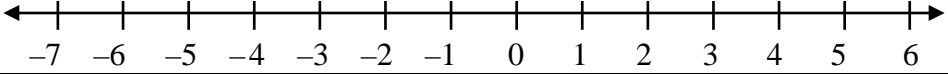
9. a. In the following diagram, name each arrow and the integer each represents.
    b. Write the subtraction equation, using integers, beginning with the arrows AB, CD and the answer EF.
    c. Write the subtraction equation, using integers, beginning with the arrows HG, JI and the answer KL.

10. a. Write the subtraction expression represented by the arrows on each number line.
    b. Write the integer that represents the difference.

i. $(+4) - (\quad)$ $=$	
ii.	
iii.	
iv.	

11. a. Illustrate each difference on a number line.
    b. Draw an arrow to represent the difference.
       [*The answer is drawn from the position where you began to the position where you end.*]
    c. Write the integer that represents the difference.

i. $(+2)-(+3)$	
$=$	←——+——+——+——+——+——+——+——+——+——+——+——+——+——→ -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6
ii. $(+2)-(-3)$	
$=$	←——+——+——+——+——+——+——+——+——+——+——+——+——+——→ -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6
iii. $(-3)-(+4)$	
$=$	←——+——+——+——+——+——+——+——+——+——+——+——+——+——→ -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6
iv. $(-1)-(-4)$	
$=$	←——+——+——+——+——+——+——+——+——+——+——+——+——+——→ -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6
v. $(-3)-(-3)$	
$=$	←——+——+——+——+——+——+——+——+——+——+——+——+——+——→ -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6

12. Represent each of the following on a number line and compare the results.
    a. $(+3)-(-2)$ and $(+3)+(+2)$
    b. $(+5)-(+2)$ and $(+5)+(-2)$
   c. $(-3)-(+4)$ and $(-3)+(-4)$

13. a. Use your results from question 12 to complete the following sentence.
       "To subtract an integer, _____".

    b. Write the following subtraction equations as addition equations. [E.g. $(-3)-(+4)=(-3)+(-4)$]

Subtraction Equation	Addition Equation
$(+7)-(+5)=+2$	$(\ \ )+(\ \ )=$
$(-7)-(-5)=-2$	
$(+7)-(-5)=+12$	
$(-7)-(+5)=-12$	

14. Determine the value of each of the following.

a. $(+1)+(+5)$ b. $(+4)+(-2)$ c. $(+6)+(-7)$ d. $(-8)+(-1)$

e. $(+4)-(+3)$ f. $(+3)-(+5)$ g. $(+7)-(-2)$ h. $(-6)-(-4)$

i. $(-7)+(+5)$ j. $(-6)+(-3)$ k. $(-9)+(+9)$ l. $(-2)+(-4)$

m. $(-4)-(+3)$ n. $(-8)-(-7)$ o. $(-2)-(-2)$ p. $(-1)-(-6)$

15. Determine the missing integer for each equality.

    a. $(-5)+(\quad)=-9$ b. $(\quad)+(-4)=-6$ c. $(\quad)+(-5)=-5$

    d. $(+6)-(\quad)=-1$ e. $(\quad)-(-4)=10$ f. $(\quad)-(-1)=-7$

16. Using integers, write a mathematical expression to describe each of the following.
    a. An advance of 6 km and then a retreat of 4 km.
    b. A win by 12 points and then a loss by 7 points.
    c. A profit of \$10 and then an additional profit of \$12.
    d. A loss of \$25 and then profits of \$6 and \$8.

17. The temperature in Waterloo was $-5°C$ at sunrise. By noon the temperature had risen by 12 Celsius degrees. What was the temperature in Waterloo at noon?

18. A submarine was in a resting position 400 m below sea level. It rose 225 m. Determine its new depth?

19. Mt. Logan, the highest point in Canada, is 5951 m high. The Dead Sea, the lowest elevation on Earth, is 430 m below sea level.
    a. Write integers to represent the height of Mt. Logan and the elevation of the Dead Sea.
    b. Determine the difference in their elevations.

20. **Archimedes** of Syracuse was born in 287 BC. Carl Friedrich **Gauss** was born in 1777. How many years later than Archimedes was Gauss born?
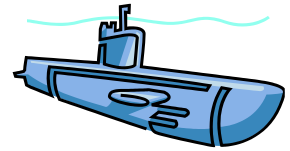
Don't forget now! Go to *www.wiredmath.ca* for the link.

TRY THESE!

Adding one- and two-digit Integers
http://www.berghuis.co.nz/abiator/maths/sa/saintegeradd2.html

Subtracting Integers
http://www.berghuis.co.nz/abiator/maths/sa/saintegersub1.html

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CHALLENGE YOURSELF!

21. Two numbers have a sum of 33. If one of the numbers is -37, what is the other number?

22. Find the difference if the sum of the first 60 positive even integers is subtracted from the sum of the first 61 positive odd integers.

EXTENSION

23. Starting at 777 and counting backwards by 7s, a student counts 777, 770, 763, and so on. Which of the numbers 41, 42, 43, 44, and 45 will be counted?