Grade 8

Number Sense and Numeration: Integers

Play **Circle 0** http://nlvm.usu.edu/en/nav/frames_asid_122_g_3_t_1.html?open=instructions first.
You may also go to www.wiredmath.ca for the link.

A Convention for Positive Integers

It is more convenient to write 3 than $+3$.
It is customary to write numbers as natural numbers instead of the symbols for positive integers.

E.g. $(+3)+(+4)=(3)+(4)=(7)$ or more simply we write $(+3)+(+4)=3+4=7$
E.g. $(+4)\times(+5)=4\times5=20$

1. Rewrite each of the following using the convention for Positive Integers and then calculate the answer.

a. $(+5)+(+4)$	b. $(+6)+(+7)$	c. $(+10)+(+5)$	d. $(+14)+2$
e. $(+25)+(+20)$	f. $(+43)+(+7)$	g. $(+33)+(+22)$	h. $15+(+85)$
i. $(+4)+(+6)+(+15)$	j. $(+23)+(+12)+1$	k. $60+(+7)+(+13)$	l. $25+(+9)+6$
m. $(+5)\times(+3)$	n. $(+8)\times(+6)$	o. $(+9)\times(+4)$	p. $(+8)\times(+4)$
q. $(+40)\times(+3)$	r. $(+1)\times(+17)$	s. $(+7)\times(+9)$	t. $(+7)\times(+6)$
u. $5\times(+7)\times(0)$	v. $(+11)\times(+10)\times3$	w. $(+3)\times9\times(+2)$	x. $7\times(+4)\times2$

Subtracting Integers

It is customary to write:

a. $(+3)-(+4)$	b. $(+3)-(-4)$	c. $(-3)-(+4)$	d. $(-3)-(-4)$
$=3-4$	$=3+4$	$=-3-4$	$=-3+4$
$=-1$	$=7$	$=-7$	$=1$

To subtract an integer, add its opposite.

2. Rewrite each of the following without brackets and unnecessary signs, and then calculate the answer.

a. $(+11)-(+4)$	b. $(+4)-(-5)$	c. $(-14)-(+6)$	d. $(-9)-(-6)$
e. $(+7)-(-9)$	f. $(-22)-(+8)$	g. $(-8)-(-7)$	h. $(+34)-(+15)$
i. $(-18)-(-6)$	j. $(+6)-(-7)$	k. $(+5)-(+11)$	l. $(-15)-(+8)$
m. $(-14)-(-6)$	n. $(-9)-(-11)$	o. $(-13)-(-9)$	p. $(-53)-(+7)$
q. $(+5)-(+3)-(+8)$	r. $(+12)-(+16)+4$	s. $23-(+17)-(14)$	t. $19-(-6)-15$

Multiplying Integers

The operation for multiplication can be represented using the cross ($\times$), the dot (·), brackets ( )( ), or the asterisk (*) or (*).

E.g. a. 3×5 (cross) b. $3 \cdot 5$ (dot) c. $(3)(5)$ (brackets) d. $3 * 5$ or 3*5 (asterisk)

For each case above, the product is 15.
The dot is used infrequently because it is sometimes confused with a decimal point.
The asterisk is used in mathematics and computing.

3. Calculate each of the following.

a. $(-5) \times (+8)$ b. $(-6) \times (9)$ c. $-(-40) \div (-4)$ d. $\dfrac{(-18)}{-(-6)}$

e. $-7(-8)$ f. $-2(5)$ g. $4(-7)$ h. $(-8)(9)$

i. $\dfrac{28}{-7}$ j. $\dfrac{-56}{8}$ k. $\dfrac{-45}{-5}$ l. $\dfrac{72}{-9}$

m. $5(-3)(-1)(-1)$ n. $(-1)(-1)(-1)(-1)$ o. $-6(2)(-3)(-4)$ p. $\dfrac{8(-2)(-3)}{(-4)(6)}$

4. Using the order of operations, calculate each of the following.

a. $(8-3)-(4-5)$ b. $-48-(14-16)$ c. $(19-9)-(-16)$ d. $(6-9)-(5+6)$

e. $9(7)-5(-2)$ f. $6(-5)-7(-8+2)$ g. $(7-6)-4(-8)$ h. $\dfrac{4-16}{3}$

i. $\dfrac{25+(-21)}{-4}$ j. $\dfrac{49-7}{-7}$ k. $\dfrac{-6-(18)}{-4}$ l. $\dfrac{8-(-6)}{-2}$

m. $\dfrac{-27-(9)}{-11-(-2)}$ n. $\dfrac{102-(-42)}{-56+2(4)}$ o. $-10 \times 10-2(-29)$ p. $\dfrac{-100-(+50)}{6-(-4)+(-5)}$

Did You Know?

Given a positive integer n, we define n factorial to be $n! = n \times (n-1) \times \ldots \times 3 \times 2 \times 1$.

E.g. $5! = 5 \times 4 \times 3 \times 2 \times 1$

$12! = 12 \times 11 \times 10 \times \text{K} \times 3 \times 2 \times 1$

$99! = 99 \times 98 \times 97 \times \text{K} \times 3 \times 2 \times 1$

5. a. Which sum is farther from zero, the sum of 83 and 128, or the sum of -76 and -132? Explain.
b. Which sum is farther from -10, the sum of -187 and 64, or the sum of 53 and -170? Explain.
c. Which value is closer to zero, the product of 52 and -124 or the integer quotient of 134 064 and 21.

6. Air temperature decreases approximately 6 degrees Celsius for every 1000 metres increase in elevation. The temperature at the peak of a mountain is $-15°C$.
   a. Determine the air temperature outside an airplane 3000 metres above the peak of the mountain.
   b. Find the air temperature at a point 2000 metres below the peak.

7. A water tower that holds 1 134 000 litres of water is full. From 6 a.m. to 9 a.m. water flows out of the tank at 4000 L/min. At the same time, water flows into the tank at 850 L/min.
   a. How much water is in the tank at 9 a.m.?
   b. If the inflow and outflow of the water remains the same as in part (a), then at what time would the water tower be empty?

Don't forget now! Go to www.wiredmath.ca for the link.

TRY THESE!

Multiplying Integers

http://www.berghuis.co.nz/abiator/maths/sa/saintegermultiply.html

CHALLENGE YOURSELF!

8. The letters *a*, *b*, *c*, and *d* are each represented by different single digit integers. When the four-digit number *abcd* is multiplied by 9, the result is the four-digit number *dcba*. In other words, the digits have been reversed after the multiplication. What is the sum of $a+b+c+d$?

EXTENSIONS

9. Weighing the baby at the clinic was a problem. The baby would not keep still and caused the scales to wobble. So the father held the baby and stood on the scales while the doctor read off 78 kg. Then the mother held the baby while the doctor read off 69 kg. Finally the father held the mother while the doctor read off 137 kg. How much did the baby weigh in kg?

10. We can write '384' as '$\overline{4}24$', the double over-bar indicating a *negative* digit, so $\overline{4}24 = 4\times100 - 2\times10 + 4$.

    a. Using double over-bar notation, which of these could be a representation for 1988?
       i. $\overline{2}\overline{1}02$ ii. $20\overline{0}2$ iii. $\overline{2}\overline{1}22$ iv. $21\overline{1}\overline{1}2$ v. $201\overline{2}$

    b. Using double over-bar notation, write a representation for each of the following integers.
       i. 2005 ii. 2006 iii. 2010 iv. 2015

    c. Explain whether or not there is any practical purpose in using double over-bar notation instead of integers to represent numbers?