WALT Multiply and divide integers

Success Criteia I know how to apply the following rules

1.(positive)x (positive)= positive

2. (Positive) x (Negative) = Negative

3. (Negative) x(Negative) = positive

4. (Negative) x(Positve)= Negative

1 Simplify:

a 2×3	**b** $2 \times {}^{-}3$	**c** ${}^{-}2 \times 3$	**d** ${}^{-}2 \times {}^{-}3$
e $8 \times {}^{-}2$	**f** 8×2	**g** ${}^{-}8 \times 2$	**h** ${}^{-}8 \times {}^{-}2$
i 7×11	**j** ${}^{-}7 \times {}^{-}11$	**k** $7 \times {}^{-}11$	**l** ${}^{-}7 \times 11$
m 0×3	**n** ${}^{-}2 \times 0$	**o** ${}^{-}3 \times {}^{-}6$	**p** ${}^{-}5 \times {}^{-}5$

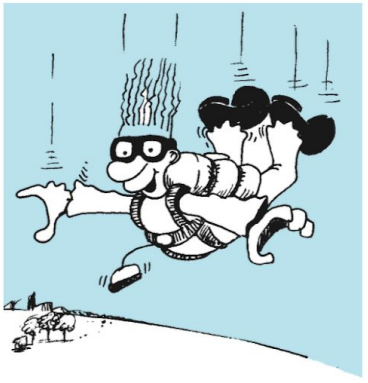
2 Determine the missing integer for each of the following:

a ${}^{-}2 \times \square = {}^{-}16$	**b** ${}^{-}2 \times \square = 16$	**c** $5 \times \square = 10$
d ${}^{-}5 \times \square = 10$	**e** $\square \times 4 = {}^{-}12$	**f** $\square \times {}^{-}4 = 12$
g ${}^{-}4 \times \square = 20$	**h** ${}^{-}4 \times \square = {}^{-}20$	**i** $3 \times \square = {}^{-}15$
j ${}^{-}3 \times \square = {}^{-}15$	**k** $\square \times {}^{-}6 = 18$	**l** $\square \times {}^{-}6 = {}^{-}18$

3 Use a negative sign as appropriate in the following questions and solve:

a A gambler loses \$8 per race for seven successive races. How much did she lose?

b A skydiver falls 200 metres per second for 30 seconds. How many metres did he fall?



Example 11

Simplify:

a ${}^{-}2 \times 5 \times {}^{-}3$ **b** $({}^{-}3)^2$ **c** $({}^{-}2)^3$

a $-2 \times 5 \times -3$
$= -10 \times -3$
$= 30$

b $(-3)^2$
$= -3 \times -3$
$= 9$

c $(-2)^3$
$= -2 \times -2 \times -2$
$= 4 \times -2$
$= -8$

4 Simplify:

a $3 \times {}^{-}2 \times 5$	**b** ${}^{-}2 \times {}^{-}1 \times {}^{-}3$	**c** ${}^{-}1 \times 3 \times {}^{-}4$
d $({}^{-}7)^2$	**e** $({}^{-}1)^3$	**f** $4 \times {}^{-}1 \times {}^{-}5$
g $5 \times {}^{-}2 \times {}^{-}4$	**h** ${}^{-}7 \times {}^{-}2 \times 2$	**i** $({}^{-}2)^3$
j ${}^{-}2 \times 5^2$	**k** ${}^{-}2 \times ({}^{-}3)^2$	**l** $({}^{-}2)^2 \times {}^{-}6$

5 Do $({}^{-}2)^2$ and -2^2 have the same value?

6 Calculate:

a $({}^{-}1)^2$	**b** $({}^{-}1)^3$	**c** $({}^{-}1)^4$	**d** $({}^{-}1)^5$
e $({}^{-}1)^6$	**f** $({}^{-}1)^7$	What do you notice?	

7 Using the results of question **6** find:

a $({}^{-}1)^{26}$	**b** $({}^{-}1)^{87}$	**c** $({}^{-}1)^{\text{even number}}$	**d** $({}^{-}1)^{\text{odd number}}$

If $12 \div 4 = 3$, the questions arise:

- What is $12 \div {}^{-}4$?
- What is ${}^{-}12 \div 4$?
- What is ${}^{-}12 \div {}^{-}4$?

Rules for **division** are identical to those of multiplication.

This is not surprising as multiplication and division are **inverse operations.**

For example, $\div$ by 2 is the same as $\times$ by $\frac{1}{2}$.

RULES FOR DIVISION:

(positive) ÷ (positive) = (positive)
(positive) ÷ (negative) = (negative)
(negative) ÷ (positive) = (negative)
(negative) ÷ (negative) = (positive)

Notice that the division of numbers with **like** signs is **positive** and the division of numbers with **unlike** signs is **negative**.

Example 12

Calculate:

a ${}^{-}6 \div 2$ **b** $8 \div {}^{-}4$ **c** $\dfrac{{}^{-}14}{{}^{-}2}$

a ${}^{-}6 \div 2 = {}^{-}3$

b $8 \div {}^{-}4 = {}^{-}2$

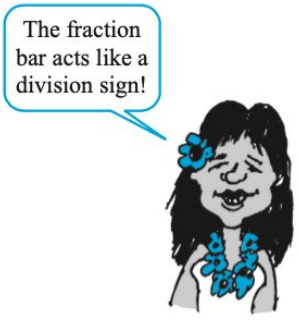
c $\dfrac{{}^{-}14}{{}^{-}2} = 7$

1 Calculate:

a	$14 \div 7$	**b**	$14 \div {}^{-}7$	**c**	${}^{-}14 \div 7$	**d**	${}^{-}14 \div {}^{-}7$
e	$30 \div 5$	**f**	${}^{-}30 \div {}^{-}5$	**g**	${}^{-}30 \div 5$	**h**	$30 \div {}^{-}5$
i	$8 \div 8$	**j**	$8 \div {}^{-}8$	**k**	${}^{-}8 \div 8$	**l**	${}^{-}8 \div {}^{-}8$
m	$24 \div 4$	**n**	$24 \div {}^{-}4$	**o**	${}^{-}24 \div {}^{-}4$	**p**	${}^{-}24 \div 4$

2 Calculate:

a	$\frac{12}{3}$	**b**	$\frac{{}^{-}12}{3}$	**c**	$\frac{12}{{}^{-}3}$	**d**	$\frac{{}^{-}12}{{}^{-}3}$
e	$\frac{22}{2}$	**f**	$\frac{22}{{}^{-}2}$	**g**	$\frac{{}^{-}22}{2}$	**h**	$\frac{{}^{-}22}{{}^{-}2}$
i	$\frac{18}{9}$	**j**	$\frac{18}{{}^{-}9}$	**k**	$\frac{{}^{-}18}{{}^{-}9}$	**l**	$\frac{{}^{-}18}{9}$



3 Find the missing integer for each of the following:

a	$24 \div \square = {}^{-}4$	**b**	$24 \div \square = 4$	**c**	${}^{-}18 \div \square = 9$
d	${}^{-}18 \div \square = {}^{-}9$	**e**	${}^{-}27 \div \square = {}^{-}3$	**f**	${}^{-}27 \div \square = 3$
g	$\square \div {}^{-}5 = 7$	**h**	$\square \div {}^{-}5 = {}^{-}7$	**i**	$\square \div {}^{-}2 = {}^{-}8$
j	$\square \div {}^{-}2 = 8$	**k**	$\square \div 3 = {}^{-}5$	**l**	$\square \div {}^{-}3 = 5$
m	$\square \div {}^{-}4 = {}^{-}4$	**n**	$\square \div {}^{-}4 = 4$	**o**	$7 \div \square = {}^{-}7$
p	${}^{-}7 \div \square = 7$	**q**	$\square \div \square = 1$	**r**	$\square \div \square = {}^{-}1$

4 Use a negative sign as appropriate in the following questions and solve:

a A company owned equally by four people has a debt of \$320 000. What is each person's share of the debt?

b One night in Siberia, the temperature drops 18°C in six hours. What is the average temperature change per hour?

Challenge combined operations

The order of operations rules also apply to negative numbers.

- **B**rackets are evaluated first.
- **E**xponents are calculated next.
- **D**ivisions and **M**ultiplications are done next, in the order that they appear (i.e., working from left to right).
- **A**ddition and **S**ubtractions are then done, in the order that they appear (i.e., working from left to right).

Example 13

Use the correct order of operations rules to calculate:

a $5 + {}^{-}8 \times 3$ **b** ${}^{-}5 - 15 \div {}^{-}5$

a
$$\begin{aligned} & 5 + {}^{-}8 \times 3 \\ &= 5 + {}^{-}24 && \{\text{multiplication first}\} \\ &= 5 - 24 && \{\text{simplify}\} \\ &= {}^{-}19 \end{aligned}$$

b
$$\begin{aligned} & {}^{-}5 - 15 \div {}^{-}5 \\ &= {}^{-}5 - {}^{-}3 && \{\text{division first}\} \\ &= {}^{-}5 + 3 && \{\text{simplify}\} \\ &= {}^{-}2 \end{aligned}$$

1 Find the answers, using the order of operations rules:

a $3 + {}^{-}7 \times 2$ **b** ${}^{-}2 - 3 \times {}^{-}4$

c ${}^{-}4 - 18 \div 3$ **d** $(5 - 10) \times (3 - 5)$

e ${}^{-}10 + 2 \times {}^{-}4$ **f** $3 \times {}^{-}4 + {}^{-}5 \times {}^{-}2$

g $(8 - 12) \times 3 - 7$ **h** $8 - 12 \times (3 - 7)$

i $8 - 12 \times 3 - 7$ **j** $7 - 2 \times {}^{-}3 + 4 \times {}^{-}5$

2 Mac Ltd. makes a \$70 000 loss per month for four months and then a \$40 000 profit for each of the next eight months. What was the year's result?

3 Debbies Dresses show the following sales record over a six week period:
Week 1, \$1214 profit; Week 2, \$867 profit; Week 3, \$126 loss;
Week 4, \$992 profit; Week 5, \$543 loss; Week 6, \$2150 profit.

a What is Debbie's overall profit or loss during this period?

b What is Debbie's average weekly earnings during this period?

4 The temperature of a bottle of water is 18^oC. The bottle is placed in a freezer that cools the water at 5^o per hour. What is its temperature after 4 hours?

5 To explore for gold, a mining company uses a drilling rig to take core samples from below the ground. Gold samples were found at the following levels:

Sample	*Level*
A	${}^{-}113$ m
B	${}^{-}42$ m
C	${}^{-}119$ m
D	${}^{-}78$ m

a Which sample is closest to ground level?

b Which sample is the deepest?

c What is the difference in depth between sample B and D?

d The cost of drilling is \$60 per m. What was the cost of taking sample A?

e What was the average depth of the gold samples?

Extension

Example 14

Calculate:

a $\dfrac{5 \times {}^{-}12}{7 - 3}$ **b** $\dfrac{{}^{-}36}{{}^{-}3 \times {}^{-}4}$

a $\dfrac{5 \times {}^{-}12}{7 - 3}$

$= \dfrac{{}^{-}60}{4}$

$= {}^{-}15$

b $\dfrac{{}^{-}36}{{}^{-}3 \times {}^{-}4}$

$= \dfrac{{}^{-}36}{12}$

$= {}^{-}3$

For more complicated fractions, work out the numerator and the denominator first, and **then divide**.

6 Calculate:

a $\dfrac{3 \times {}^{-}2}{6}$ **b** $\dfrac{{}^{-}4 \times {}^{-}2}{{}^{-}8}$ **c** $\dfrac{3 \times {}^{-}4}{6}$ **d** $\dfrac{12}{{}^{-}2 \times {}^{-}3}$

e $\dfrac{3 \times {}^{-}5}{7 - 2}$ **f** $\dfrac{{}^{-}3 \times {}^{-}4}{5 - 1}$ **g** $\dfrac{{}^{-}3 \times {}^{-}6}{5 - 7}$ **h** $\dfrac{3 \times {}^{-}6}{{}^{-}2 \times 3}$