

Function Builder Lab

Turn changing quantities into rules.

HIGH SCHOOL • HSF-BF.A.1a

CCSS.Math.Content.HSF-BF.A.1a "Determine an explicit expression, a recursive process, or steps for calculation from a context."

NAME _____

DATE _____

BUILD THE RULE

For a quantity that changes by the same amount each time, begin with the starting amount and add the rate times the input. For a quantity that is repeatedly multiplied, state the starting value and multiply by the same factor for each new step.

WORKED EXAMPLE

A pop-up photo booth charges a \$13 setup fee and \$17 for each printed strip. Write an explicit expression for the total cost $T(n)$ for n strips.

1. Let n represent the number of printed strips.
2. The setup fee contributes 13 dollars.
3. The strips contribute $17n$ dollars.
4. Add the two parts: $T(n) = 13 + 17n$.

Answer: $T(n) = 13 + 17n$

PRACTICE 6 problems

- 1** A bike-share ride costs \$4 to unlock and \$3 for each 10-minute block. Write an explicit expression $C(b)$ for the cost of b blocks.

ANSWER _____

- 2** A game character has 5 energy units at level 1. At each later level, the character has 2 more energy units than at the previous level. Write a recursive rule for $E(n)$.

ANSWER _____

- 3** A school's recycling contest collects 6 cans on day 1. Each following day, it collects 3 times as many cans as the day before. Write a recursive rule for $c(n)$.

ANSWER _____

- 4** A playlist has 8 songs this week. You add 4 songs each week. Write an explicit expression $P(w)$ for the number of songs after w weeks.

ANSWER _____

- 5** A digital art file is 2 MB after its first saved version. Its size doubles with each later revision. Write a recursive rule for $A(r)$.

ANSWER _____

- 6** A club pays \$9 for a booth permit and earns \$5 from each bracelet sold. Write an explicit expression $P(x)$ for the club's profit after selling x bracelets.

ANSWER _____

APPLY IT Show your work

- 1** You have \$15 saved for a concert ticket. You earn \$8 for each dog-walking job. Write an explicit expression $S(j)$ for the amount saved after j jobs.

WORK SPACE

ANSWER _____

- 2** A student's tutorial video is watched by 7 people on day 1. Each following day, the number of new viewers is twice the previous day's number. Write an explicit expression $V(d)$ for the number of new viewers on day d .

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A coding club completes 1 challenge on day 1, 4 challenges on day 2, 9 challenges on day 3, and 16 challenges on day 4. Write an explicit expression $D(d)$ for the number of challenges completed on day d . Then explain why a recursive rule that adds one fixed amount each day does not fit this pattern.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	A bike-share ride costs \$4 to unlock and \$3 for each 10-minute block. Write an explicit expression $C(b)$ for the cost of b blocks.	$C(b) = 4 + 3b$
2	A game character has 5 energy units at level 1. At each later level, the character has 2 more energy units than at the previous level. Write a recursive rule for $E(n)$.	$E(1) = 5, E(n) = E(n-1) + 2$ for $n \geq 2$
3	A school's recycling contest collects 6 cans on day 1. Each following day, it collects 3 times as many cans as the day before. Write a recursive rule for $c(n)$.	$c(1) = 6, c(n) = 3c(n-1)$ for $n \geq 2$
4	A playlist has 8 songs this week. You add 4 songs each week. Write an explicit expression $P(w)$ for the number of songs after w weeks.	$P(w) = 8 + 4w$
5	A digital art file is 2 MB after its first saved version. Its size doubles with each later revision. Write a recursive rule for $A(r)$.	$A(1) = 2, A(r) = 2A(r-1)$ for $r \geq 2$
6	A club pays \$9 for a booth permit and earns \$5 from each bracelet sold. Write an explicit expression $P(x)$ for the club's profit after selling x bracelets.	$P(x) = 5x - 9$

PART 2 • APPLY IT

- $S(j) = 15 + 8j$ The starting savings amount is 15 dollars. Each job adds 8 dollars, so add $8j$ to 15.
- $V(d) = 7 \cdot 2^{(d-1)}$ The first-day value is 7 when $d = 1$. The factor of 2 is applied $d - 1$ times.

CHALLENGE

$D(d) = d^2$. The increases are 3, 5, and 7, not one fixed amount, so a fixed-addition recursive rule does not fit.

Accept equivalent algebraic forms, such as $3b + 4$ for $C(b)$. For recursive rules, accept equivalent notation when the initial value, repeated operation, and starting index are all correct.