MATHWRIGHT / GRADES 6–7 / ALGEBRA

Arcade Algebra Challenge

Your ticket comes with 24 tokens. Can you make a plan that uses them all?

Name _____ Date _____

ROCKET DASH	PIXEL HOOPS	LASER MAZE
3 tokens per play	4 tokens per play	5 tokens per play

The arcade keeps 2 tokens from your 24-token budget for entry. You pay this fee once. You can play any game more than once.

1a How many tokens are left for games after you pay to enter?

1b Start with 2 rounds of Pixel Hoops. Draw or write a token receipt showing entry, game cost, and how many tokens you have left.

1c Could you add 3 rounds of Laser Maze to that receipt? Show how you know.

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Build a token rule

Use a variable to describe the cost of any number of plays.

TRY ONE TOGETHER

If p is the number of Rocket Dash plays, 3p gives the game cost. For 2 plays, replace p with 2. The game cost is 3 × 2 = 6 tokens. Then add the 2-token entry fee to get 8.

2a Write an expression for the total cost, including entry, of p Rocket Dash plays. Circle the part that represents the entry fee.

2b Use your expression to find the total for 0, 3, and 5 Rocket Dash plays. What does the cost for 0 plays represent?

2c Let h stand for the number of Pixel Hoops plays. Write an expression for the total with entry. Use it to find the cost of 4 plays.

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Match the receipts

Connect each expression to the receipt it describes.

In every expression, n is the number of plays of one game. Write a letter beside each expression. Use each letter once.

A Pixel Hoops plus entry

B Laser Maze with the entry fee already paid

C Rocket Dash plus entry

D Laser Maze plus entry

3.1. **2 + 5n** _____

3.2. **3n + 2** _____

3.3. **4n + 2** _____

3.4. **5n** _____

3a Which two expressions on the list differ by exactly 2 tokens for every value of n? Explain what that difference means.

3b A friend says 2 + 5n and 7n give the same cost. Test both expressions at n = 2. What happens?

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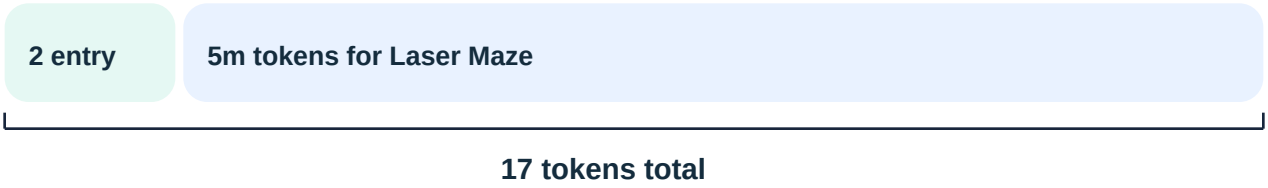
Balance the token bill

Use a bar model to find the missing number of plays.

A RECEIPT FOR 17 TOKENS

The receipt includes entry and Laser Maze only. Each play costs 5 tokens. Let m be the number of plays.



4a Use the bar model to explain why 2 + 5m = 17. Solve for m and check by rebuilding the receipt.

4b A second receipt totals 22 tokens for entry and Pixel Hoops only. Write and solve an equation to find the number of plays.

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Fix the scorecard

Use equivalent expressions to check how the arcade counts plays.

TWO ROUNDS OF GAME TIME

You play Rocket Dash r times before lunch and 2 more times after lunch. Your total also includes the 2-token entry fee. The game portion of your bill is 3(r + 2).

5a Complete 3(r + 2) = 3r + ____. Draw groups or use the distributive property to show where the missing number comes from.

5b Tess says 3(r + 2) = 3r + 2. Test her expression and yours with r = 1. Explain her mistake.

5c Include the 2-token entry fee. Write the full cost as 2 + 3(r + 2), then simplify it.

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Spend exactly 24 tokens

Find two different ways to use your whole arcade budget.

BUILD YOUR COST MODEL

Let r, h, and m be the numbers of Rocket Dash, Pixel Hoops, and Laser Maze plays. The full cost is 2 + 3r + 4h + 5m. Start with r, h, and m as whole numbers.

Your two plans must each include at least one play of every game. You can sketch token groups or use the table to keep track.

Plan	Rocket Dash	Pixel Hoops	Laser Maze	Total cost
A				
B				

6a Fill in both rows. Substitute each set of numbers into the cost expression to show that it works.

6b Which of your two plans has more total plays? Explain how you counted.

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Design a player pass

Switch roles. Make a receipt puzzle for another player to solve.

YOUR DESIGN BRIEF

Use the original game prices. Include one 2-token entry fee. Pick one game only and a total that is affordable with 24 tokens. Your receipt must include at least one play.

7a Write your receipt puzzle. Give the total and the game name, and ask your partner to find the number of plays.

7b Partner check. Write an equation, solve it, and substitute your answer to verify the total.

7c Try another total for the same game that is within budget but cannot be made with whole plays. Explain why.

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Token rules and receipts

Worked solutions for student pages 1–3

Page 1 / Arcade Algebra Challenge

1a 24 minus 2 = 22 tokens left for games.

1b Entry costs 2 tokens and 2 rounds of Pixel Hoops cost 2 × 4 = 8. The receipt totals 10 tokens, leaving 14.

1c Three rounds of Laser Maze cost 3 × 5 = 15 tokens. Only 14 tokens remain, so you are 1 token short.

Page 2 / Build a token rule

2a 3p + 2. Circle the 2 because it represents the entry fee.

2b At p = 0, the total is 3 × 0 + 2 = 2 tokens, which pays for entry only. At p = 3, the total is 3 × 3 + 2 = 11. At p = 5, the total is 3 × 5 + 2 = 17.

2c The expression is 4h + 2. For 4 plays, 4 × 4 + 2 = 18 tokens.

Page 3 / Match the receipts

3.1–4 3.1 is D, 3.2 is C, 3.3 is A, and 3.4 is B.

3a 2 + 5n and 5n. Both cover the same number of Laser Maze plays. The first expression adds the 2-token entry fee.

3b At n = 2, 2 + 5 × 2 = 12, while 7 × 2 = 14. The 2-token fee is paid once. The expression 7n charges it for every play.

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Equations and expressions

Worked solutions for student pages 4–5

Page 4 / Balance the token bill

4a The receipt has 2 tokens for entry and 5 tokens for each of m plays.

2 + 5m = 17. Subtract 2 from both sides to get 5m = 15.

Divide both sides by 5 to get m = 3. Check. 2 + 5 × 3 = 17 tokens.

4b Let h be the number of Pixel Hoops plays. Then 2 + 4h = 22.

Subtract 2 from both sides to get 4h = 20. Divide both sides by 4 to get h = 5. Check. 2 + 4 × 5 = 22 tokens.

Page 5 / Fix the scorecard

5a 3(r + 2) = 3r + 6. There are r plays before lunch at 3 tokens each and 2 plays after lunch at 3 tokens each.

5b At r = 1, the game cost is 3(1 + 2) = 9 tokens. Tess gets 3 × 1 + 2 = 5. She counts the 2 extra plays as 2 tokens. They actually cost 6 tokens.

5c 2 + 3(r + 2) = 2 + 3r + 6 = 3r + 8. The 8 covers entry and the 2 after-lunch plays.

Arcade plans and puzzles

Worked solutions for student pages 6–7

Page 6 / Spend exactly 24 tokens

6a Two possible plans are shown below. Accept any two different plans that include every game and total 24 tokens.

Plan	Rocket Dash	Pixel Hoops	Laser Maze	Total cost
A	3	2	1	24
B	1	1	3	24

A $2 + 3 \times 3 + 4 \times 2 + 5 \times 1 = 2 + 9 + 8 + 5 = 24$.

B $2 + 3 \times 1 + 4 \times 1 + 5 \times 3 = 2 + 3 + 4 + 15 = 24$.

6b Plan A gives 3 + 2 + 1 = 6 plays. Plan B gives 1 + 1 + 3 = 5 plays. Plan A gives one more play.

Page 7 / Design a player pass

7a Sample puzzle. My total was 14 tokens for entry and Rocket Dash. How many rounds did I play?

7b $2 + 3r = 14$. Subtract 2 to get $3r = 12$. Divide by 3 to get $r = 4$. Check. $2 + 3 \times 4 = 14$ tokens.

7c A total of 15 tokens would leave 13 after entry. Since 13 is between 12 and 15, it falls between the game costs for 4 and 5 plays. There is no whole number of plays that costs exactly 13 tokens.

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