

MULTIPLICANDO



Multiplicando walked lightly along the path that followed the stream through the dense forest. The sun, high in the sky, filtered in through the leaves, and birds were singing everywhere. Multiplicando was feeling fine. Suddenly he turned three back flips in a row, and then while keeping the beat with his feet, step-step-leap, step-step-leap, he began to recite...

Here am I
'Neath the trees
The blue sky
Over me
I feel fine
And so free
The good king
Shall I see
And the queen
Queen Hellene
La la la
La la la...

The forest opened up a bit, and Multiplicando could see in the distance the towers of a castle, its flags flying on the breeze. He breathed in the good air of the day and thought about how wonderful it would be to be at the castle after his long journey. After a time he came to a ford in the stream. He bent over and scooped up some water to cool his face when he saw his reflection. "Look!" he said, "There's the magician, mathematician." Then he noticed something else. It was the stepping stones he had laid out in the stream last time he'd been by that way. The stones were arranged in a repeating pattern across the stream with two small then one

large. "Here I go!" and he stepped across the stream from stepping stone to stepping stone—step-step-leap, step-step-leap—leaping to the larger stones, landing with his feet spread-eagled.



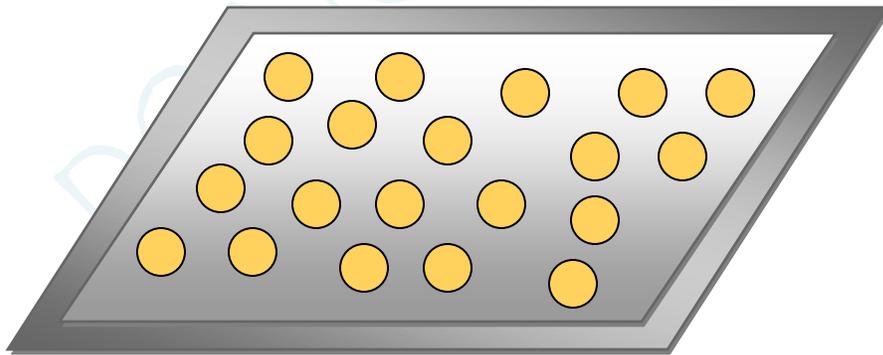
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GUS PLUS

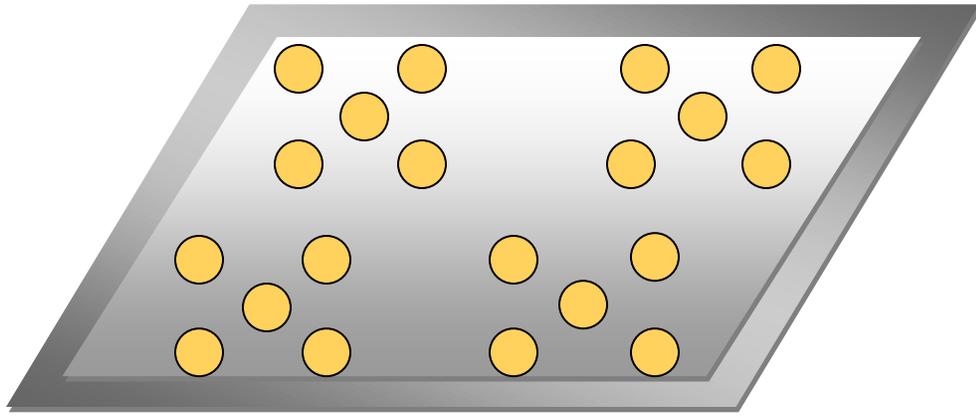
Multiplicando stood before the east gate of the castle. The guard greeted him cheerfully and let him pass. Quietly he slipped into the bakery, inhaling the warm scents. There, standing over a huge baking pan, stood a stout, red-faced baker all in white. Multiplicando tip-toed up behind him, and, in a loud whisper, called out, "Good Gus, how goes it with us." The good-natured baker, only slightly startled, replied slowly, "Why Multiplicando, where have you been?"

"Oh, you know, between here and there. I've missed you, Gus. And, I must say, I've also missed your tarts. Do you think I could have one?" he said pointing.

"Sure, go ahead, but listen my friend, do you suppose you could come back later. I'm having a tough time coming up with the right number of cookies for the king's feast tonight. It's always the same. I keep losing track. See here, 2 and 2 is 4 and 3 more is 7 and 5 more is 12 and 6 more is 18 and ... and ... and ... that's where I lose count. I just get confused."



"Well," said Multiplicando, "I can see you are fine at adding. One could call you 'Gus Plus' for that matter. Here's my solution. See how you have them laid out every which way. Why don't you lay them out like the five-card in the king's deck—two above, two below, and one in the middle," said Multiplicando reaching over the baking sheet and rearranging the cookies. "There, now all you have to do is count the ones in the middle, and count by fives as you do. You know, the way you counted for games when you were a boy."



"Oh, you mean 5, 10, 15, 20...?" replied Gus.

"Yeah, that's it!" And Multiplicando did four cartwheels in the bakery, just like that. After the first he counted FIVE—after the second he counted TEN—after the third he counted FIFTEEN—after the fourth he counted TWENTY. "There, that's 5 four times, or, as I like to say, 4 times 5 is 20," said Multiplicando, standing there spread-eagled with a big smile on his face. "Got It Gus?"

"Yes," said the baker, "Methinks I do," and a broad grin spread across his face.



THE TOWER ROOM

The king and queen were overjoyed to see Multiplicando, and the twins Raymond and Rosemary, rushed up to meet him. "King Divide, Your Highness Minus," said Multiplicando bowing low. "What did he call Mommy and Daddy?" whispered Raymond to Rosemary.

"I think he called them King Divide and Your Highness Minus, whatever in the world that means," Rosemary whispered back.

The queen, overhearing them said, "Dear children this is a joke between Multiplicando and us. He can do no wrong in our eyes. You see, it was he who brought us the Golden Scale and the Table of Multiplicando."

"The Golden Scale, what's that!" exclaimed the two at the same moment, forgetting their original question.

"Well, you are probably too young to remember, but old enough now to understand," said their mother laughing. "Multiplicando, would you be good enough to show these two to the Tower Room."

"Yes, Your Highness." answered Multiplicando bowing low.

"The Tower Room!" said Raymond excitedly. "Father always said that we could go there when we were older. Now here we are, going with Multiplicando!"

Multiplicando turned the key in the tower door and pushed it open. In the center of the small room stood a table with a golden scale upon it, which gleamed in the sunlight streaming in through the lone window. "This is the Golden Scale," pronounced Multiplicando.



Multiplicando proceeded to pour a purse full of gold coins onto the table. "Watch carefully," he said, placing some coins onto the left-hand tray. The tray went down, while the other swung upward ...

"It's like a seesaw," Raymond remarked, "but I want it to balance the way it did when it was empty."

"Okay," said Multiplicando, "let's see what we can do. Let's put some coins on the right-hand tray."

"Still doesn't balance," called out Raymond. The right hand tray had gone down part way, but not all the way.

"Let's take a look," said Multiplicando. "How many are in the left hand tray?"

"Eight," replied Rosemary immediately.

"Now, how many do we have in the right hand tray, Raymond?"

"Five," replied Raymond.

"So, Rosemary, how many more coins will it take to balance the scales?"

"Three more, I think."

"Correcto! Now why is that? You see, if I gave you 8 nuts and Raymond only five, he would say that was not fair. So to be the same, or 'equal' as a mathematician likes to say, I'd have to give Raymond three more, wouldn't I? Would it be fair to say that 8 is 5 and 3?"

Multiplicando added three coins to the lighter side, and the twins watched the Golden Scale find its equilibrium again.

"Now here's the best part," said Multiplicando. "One day as your mother and father and I were experimenting with the Golden Scale, we wanted to write down something to show that both sides are the same, or equal, when the trays are balanced. Your mother noticed that the crossbar went straight across when the trays balanced, so she suggested that we use the sign of the crossbar to show that both sides were the same. Because mathematicians like to do things the shortest way possible, I suggested

we draw two short lines to stand for the crossbar, to show an 'equals' sign because equals means 'the same as'. So in this instance we can write that $8 = 5 + 3$.

$$8 = 5 + 3$$

Suddenly there came a knock on the door. It was a servant informing them that it was time to dress for the birthday feast. As they turned to go, Rosemary realized that there was an unusual pattern on the table which seemed to be upside down. She hadn't time to be sure what she saw. It was time for the feast! Her questions would have to wait.

12	0	12	24	36	48	60	72	84	96	108	120	132	144
11	0	11	22	33	44	55	66	77	88	99	110	121	132
10	0	10	20	30	40	50	60	70	80	90	100	110	120
9	0	9	18	27	36	45	54	63	72	81	90	99	108
8	0	8	16	24	32	40	48	56	64	72	80	88	96
7	0	7	14	21	28	35	42	49	56	63	70	77	84
6	0	6	12	18	24	30	36	42	48	54	60	66	72
5	0	5	10	15	20	25	30	35	40	45	50	55	60
4	0	4	8	12	16	20	24	28	32	36	40	44	48
3	0	3	6	9	12	15	18	21	24	27	30	33	36
2	0	2	4	6	8	10	12	14	16	18	20	22	24
1	0	1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	2	3	4	5	6	7	8	9	10	11	12	

TODD AND STEVEN

The great birthday feast was held, and what a feast it was. Aside from all the wonderful food, there were sword swallowers, belly dancers, and best of all, Multiplicando performing his greatest feat, keeping 7 juggling balls aloft.

The next morning at breakfast, seeing Raymond looking quite thoughtful, Multiplicando asked him, "What's on your mind, young sir?"

"Well, I can't get it out of my mind how strangely the serving boys Todd and Steven were acting," said Raymond. "Each time people sat down at a table it was almost as if Todd and Steven would have a little squabble."

"Oh-h-h-h-h," said Multiplicando, "Do you know what they were doing? Whenever an odd number of people were seated at a table, Todd would wait on them. If there was an even number, Steven would take care of them. It's a kind of game they play."

"What do you mean, 'odd', Multiplicando?"

"Well, you know the custom in your land whereby people always sit across from people who are at the table? They pair up, even if they don't know each other."

"If they can," added Rosemary, "unless there is an extra one, then that's the odd one."

"Correcto!" said Multiplicando.

For several days afterwards Raymond and Rosemary enjoyed playing the game they called Todd and Steven's Inn. They would have a certain number of their friends sit down at a table. Then they would say,

"Todd and Steven,
Odd or Even,
Tell Me If
It's Odd or Even."

If there were an even number such as 2, 4, 6, 8 or 10, for example, then Steven would wait on the table, bringing that same number of goblets on a tray. If there were an odd number such as 1, 3, 5, 7, 9 or 11, then Todd would wait on them.

It always seems that it is easier for Steven, somehow," said Rosemary.

"I think I know why," said her brother proudly. When they're seated in pairs you just count by 2's, 2, 4, 6, 8, 10 and so on. With the odds there's always that extra one you have to add, the odd one."

"It's definitely easier to count the evens," said Rosemary.

"But not that much harder with the odds," added Raymond.

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TWOS

Raymond and Rosemary were standing up on the battlements, looking down onto the parade ground watching the palace guards marching back and forth.

"There's is something about their marching I have never noticed before. What is it?" Raymond wondered aloud.

"I know," said Rosemary, "The Captain is keeping time with his baton and the guards are all stamping hard on the right foot. Listen to the way it sounds. 1 2 3 4 5 6 7 8 9 10 11 12." The twins kept the rhythm on the stone wall, clapping on the even beat.

Tap CLAP

Tap CLAP

Tap CLAP

Tap CLAP

They even practiced marching like the guards, stamping hard on the evens.

Multiplicando was practicing cartwheels in the courtyard when they found him. "So, it looks like you've discovered the 2's table while you were playing, eh?"

"The 2's table?" questioned Raymond. "What do you mean by that?"

"Well, never mind the table part for now... Let's count by twos."

"That's easy for us," said Rosemary. "We're twins, and we do everything by two. Try us,"

"Okay, each time I do a cartwheel, that's two more. Got it?"

"Sure, let's go," said Raymond.

Multiplicando turned one cartwheel. "TWO!" shouted the twins, Then Multiplicando turned another. "FOUR!" they cried out together, and another, "SIX!"

Now he turned 4 cartwheels.

"EIGHT," they called out. "And as Multiplicando continued, the twins counted "... 10, 12, 14, 16, 18, 20, 22..."

"Last one," called Multiplicando,

"24," was the reply.

"Good work, you two, said Multiplicando. Now it's time for you two to go. Good-bye, children. See you in your dreams tonight."

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THAT NIGHT

That night when they were in their room, Raymond asked Rosemary, "How much is 2 times 2?"

"2 times 2 is 4," she replied.

"4 times 2?"

"4 times 2 is 8."

"6 times 2?" he asked.

"12," was her answer. "6 times 2 is 12. It's easy. I can see the people at the big tables seated opposite each other in pairs. If I count the people on one side then I know how many pairs there are, and I count by twos. It's starting to make sense."

"Okay, Rose, now you give me some."

"7 times 2?"

"7 times 2 is ... let's see ... 14. Another, please."

"8 times 2?"

"8 times 2 is 16. You know, Rose, I can feel the twos adding up in my mind. And, I can still feel Multiplicando doing his cartwheels."

They were so excited they couldn't sleep. "You know, Raymond, I can't stop thinking about Multiplicando." "Where's the slate, Rose," her brother asked eagerly. "I've just got to draw a picture of him." And so he did. In just a few moments they were sound asleep.



THE SIGN OF MULTIPLICANDO

The next evening, Rosemary had an idea. She took her slate and started writing. When she'd finished she called Raymond over. "See here, these numbers were just waiting for me to put them in order. I just thought it would be nice to use Multiplicando's picture when we say 'times'. Of course, not the whole picture, just a sign, like mathematicians do." Then she recited what she'd written.



2 is 1 X 2

4 is 2 X 2

6 is 3 X 2

8 is 4 X 2

10 is 5 X 2

12 is 6 X 2

14 is 7 X 2

16 is 8 X 2

18 is 9 X 2

20 is 10 X 2

22 is 11 X 2

24 is 12 X 2

THREES

"Rose, did you ever watch the way Multiplicando sometimes goes through the halls reciting rhymes as he goes? He takes two steps and then does a little leap."

"Yes I have," said Rosemary. "Maybe we can make a rhyme too. She pondered for a minute, and then started stepping like Multiplicando, step-step-leap, step-step-leap. Raymond followed along. While they were stepping Rosemary started to recite,

"Now I skip
Merrily
With no cares
Feeling free
And my feet
Fairly fly
I'm a bird
In the sky ..."

"Now, Rose, don't get carried away!"

That night while she was writing numbers on her slate by candlelight, Rosemary decided to write out the numbers according to the rhythm. That is, she circled every third number. 1, 2, (3), 4, 5, (6), 7, 8, (9), 10, 11, (12), 13, 14, (15), 16, 17, (18), 19, 20, (21), 22, 23, (24), 25, 26, (27), 28, 29, (30), 31, 32, (33), 34, 35, (36) Having finished this she wiped the slate clean leaving only the circled numbers.

3 6 9 12 15 18 21 24 27 30 33 36

In the morning she had a new idea. Calling to Raymond she said, "Raymond I'm going to make a slate of the threes as well. And I'm going to put the 'times' sign of Multiplicando and also use the 'equals' sign he showed us from the Golden Scale."

When she'd written up to $36 = 12 \times 3$ she couldn't bear the thought of erasing it, so she decided to ask her parents if she could have a second slate. She leaned it up, against the wall of her chamber and looking at it wondered what Multiplicando had meant that day in the courtyard when he had said 'twos table.' Suddenly, she had an inkling, and she wrote, 'Rosemary's Table of Threes'.

Rosemary's Table of Threes

$$3 = 1 \times 3$$

$$6 = 2 \times 3$$

$$9 = 3 \times 3$$

$$12 = 4 \times 3$$

$$15 = 5 \times 3$$

$$18 = 6 \times 3$$

$$21 = 7 \times 3$$

$$24 = 8 \times 3$$

$$27 = 9 \times 3$$

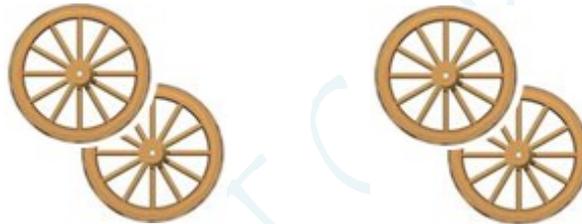
$$30 = 10 \times 3$$

$$33 = 11 \times 3$$

$$36 = 12 \times 3$$

FOURS

The twins loved to visit their friend Walter the Wheelwright in his shop. Walter was a very careful worker, very proud of his work. Sometimes when the twins peered in the door they would hear him saying, "EVERY WHEEL MUST BE RIGHT TO BE A WALTER WHEELWRIGHT WHEEL." They didn't in any way want to offend him, but they found themselves whispering these words just because they were such fun to say. They could see how he worked, always the same way. As he would finish the wheels for one wagon he would lay them out in two pairs, two wheels for the front and two for the back.



This day Rosemary didn't feel like staying to chat with Walter, but Raymond stayed behind. On her way home Rosemary decided to count her twos by two. This was a way of counting fours, she realized. She started a counting march, beginning with two, counting by two and stepping hard on the second number ... 2 4 6 8 10 12 14 16 18 20 ... all the way home. Then on her slate she wrote this out and circled every second number. 2 (4) 6 (8) 10 (12) 14 (16) 18 (20) 22 (24) 26 (28) 30 (32) 34 (36) 38 (40) 42 (44) 46 (48) ...

Then she wiped the slate clean and wrote out her fours.

4 8 12 16 20 24 28 32 36 40 44 48

That evening she took out her new slate and wrote,

"Rosemary's Table of Fours"

Rosemary's Table of Fours

$$4 = 1 \times 4$$

$$8 = 2 \times 4$$

$$12 = 3 \times 4$$

$$16 = 4 \times 4$$

$$20 = 5 \times 4$$

$$24 = 6 \times 4$$

$$28 = 7 \times 4$$

$$32 = 8 \times 4$$

$$36 = 9 \times 4$$

$$40 = 10 \times 4$$

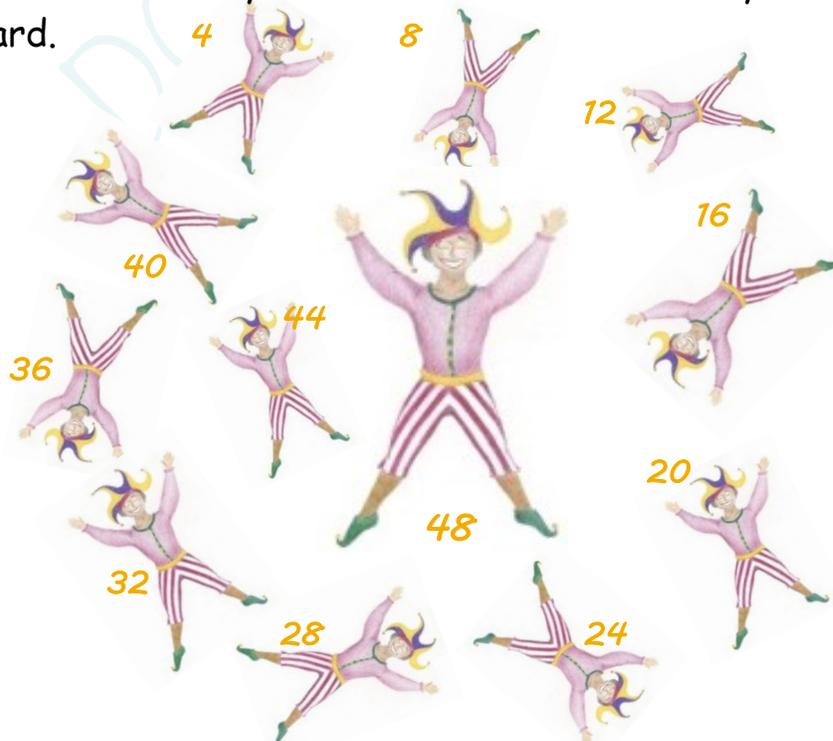
$$44 = 11 \times 4$$

$$48 = 12 \times 4$$

Rosemary couldn't wait to show Multiplicando what she had accomplished, both the slate of fours and her 'table' of threes.

"You've done well, Rosemary," he said with a twinkle in his eyes. "And you guessed right to use the 'equals' sign and 'times' sign AND the title 'Table of Threes!'" Just like that he did 12 cartwheels to show his appreciation.

She couldn't help counting as he did each one — "4 8 12 16 20 24 28 32 36 40 44 48." When they had finished counting the multiples of four Multiplicando stood there spread-eagled with his head thrown back like he always did at the end. Rosemary could have had no bigger reward.



THE SIGN OF KING DIVIDE

One day the twins ran into Multiplicando atop the castle tower where he had been practicing juggling. Now Raymond stepped forward to ask a question that he'd been burning to ask ever since Multiplicando had arrived. "Multiplicando, when are you going to tell us why you call our father 'King Divide'?"

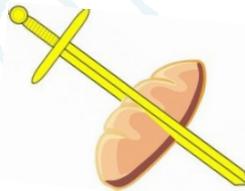
"And our mother 'Her Highness Minus,'" added Rosemary.

"Well, I suppose there's no time like the present," answered Multiplicando. "Did you know that your father actually came from very humble beginnings? He was living with his mother, tending sheep, in a tiny cottage on the outermost reaches of the kingdom. This was in the time of the Great Famine, which many people still remember. Food was very scarce, and people were dying of hunger. The reason for this was that the old king had quarreled with an evil magician who, in revenge, had put the kingdom under a spell. This he had done by turning a loaf of bread into a stone. Until someone could split this stone, nothing would grow in the kingdom. The water dried up, and with it the crops. The king sent messengers to all corners of the kingdom to find young men worthy of the task. The one who succeeded would receive half the kingdom and the hand in marriage of Princess Hellene." Raymond and Rosemary looked at each other sheepishly.

Multiplicando continued, "Now the square all roundabout the stone lay strewn with broken swords. Worse, the kingdom's storehouses were nearly empty. All the messengers had returned, save one, Roderick. Truth to tell, dear Roderick, had gotten lost. In wandering through the highlands he found himself in need of shelter, and noticing smoke coming from a tidy little cottage, he knocked at the door. He was greeted by a red-haired lad little more than a boy. 'Please come in, and be welcome. There is a warm place for you by the hearth. My name is David, and this is my mother.'

"'What brings you to this out of the way place?' the woman inquired in a kind voice. So Roderick related the entire story, nearly leaving off the challenge, for the boy David was so young. But when he heard the challenge, the boy swelled with courage and within seconds had made up his mind to go. Over the hearth hung an old sword which his dear grandfather had once used in battle. Taking it down he prepared to leave first thing in the morning. He bid his mother good-bye, and then with Roderick, set off for the palace.

"Withered crops and starving cattle met them everywhere, but that was nothing compared to the desperate looks in the eyes of the people they encountered. At long last they arrived in the royal city. David looked around the square and, indeed, it was much as Roderick had described. Undaunted, he uttered a silent prayer, and summoning all his strength he raised his grandfather's sword overhead. Then, thinking of his dear grandfather, with all his heart and with all his might, he brought the sword down right in the center of the stone. Miraculously the stone split in two. Roderick was amazed.



"The rest of the folk had not even bothered to watch. Yet, flowers blossomed and birds sang. Before long people did begin to realize what had happened. Word was sent to the king. At length he appeared with his daughter Princess Hellene at his side. The king embraced David. The young princess' eyes met David's eyes." Raymond and Rosemary blushed once again to think of their mother as a young princess and of their father as a mere lad.

"David's mother was brought to the palace to live," Multiplicando went on. "A grand wedding was celebrated. After a number of years the old king died, and your father became king and your mother queen. Sometime after that you two came into the world, and as they say, the rest is history."

"But, Multiplicando," asked Raymond insistently, "how did my father come to be called 'King Divide'?"

"Yes, of course, I almost forgot your original question, didn't I? Well, you see, after the great deed of cleaving the stone was accomplished, the old king declared that every loaf of bread baked in the kingdom was to bear the imprint of this sign.



"Yes, I see. Here is the sword and on either side are the pieces of the bread", said Raymond.

"And, and," said Rosemary, "that stands for dividing?"

"Correcto!" Multiplicando thought for a moment and then he said, "Dear children, there is more to the story that I want Roderick himself to tell. Go seek him out."

The children were off in a flash to seek out Roderick who was now the chief steward.