

The NZ Centre of Mathematics

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w a t p s c e n t r e

## THE PASTA COMPANY - Teacher Notes

This exercise introduces prime numbers by getting students to recognise multiples and factors. If a number has factors then it can be eliminated. Within each class, you will find a range of levels of thinking with this problem. Let students express and develop their own ideas. For example, deciding whether a number like 24 is a prime might slow them down especially if the 6 and the 4 or the 8 have already been eliminated (when they got to 12 and 16).

Eventually they should get a list of machine numbers that are of “prime importance”. This could be why they are called prime numbers. Most will also get to realise that there is a relationship between multiples and primes.

The prime numbers between 0 and 100 are: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, and 97.

The second part of the exercise is a good way of introducing exponents. Rather than writing  $2 \times 2 \times 2 = 8$  it is easier to write  $2^3$  etc.

There are many mathematical reasons and proofs as to why 1 is not a prime. The easiest is to tell the students that for a number to be prime it must have TWO distinct (different) factors. The factors of 1 are 1 and 1 which are both the same number. Most mathematical definitions will note that a number is prime if it is greater than 1 and has exactly two divisors, 1 and the number itself.

The pasta machine idea shows clearly why the number 1 is not a prime number. If the unit of pasta was fed into the machine then it would come out the same length. Therefore the machine is clearly not needed and therefore 1 is not a prime number.

# The Pasta Company

Customers go to the Pasta Company to purchase fresh pasta. They can order their pasta in any length from 1 to 100. For example, if a customer wants some “36” length pasta then the raw unit of pasta is fed into the “36” machine which stretches it to “36” length.

One morning, the number 15 machine breaks down. As 15 is a popular pasta length there is much discussion on what can be done. One employee suggests that the raw unit of pasta could be fed into the 5 machine to get a “5” length and then into the 3 machine which will further stretch it to make it into a “15”. They try this method and it works!

A few days later the number 8 machine breaks down. Is there a way of making pasta of size “8”?

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After giving it some thought, the owner of the Pasta Company decides that he could save money by not having 100 machines. What are the essential machines that he needs? Below is a grid of the 100 machine numbers. Cross out all the machine numbers that are not needed.



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	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Below are all the machine numbers. Draw a circle around all the essential machine numbers. Write beside the others the mathematical equation for how the pasta can be made.

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|----------|----------|----------|----------|
| 1 .....  | 26 ..... | 51 ..... | 76 ..... |
| 2 .....  | 27 ..... | 52 ..... | 77 ..... |
| 3 .....  | 28 ..... | 53 ..... | 78 ..... |
| 4 .....  | 29 ..... | 54 ..... | 79 ..... |
| 5 .....  | 30 ..... | 55 ..... | 80 ..... |
| 6 .....  | 31 ..... | 56 ..... | 81 ..... |
| 7 .....  | 32 ..... | 57 ..... | 82 ..... |
| 8 .....  | 33 ..... | 58 ..... | 83 ..... |
| 9 .....  | 34 ..... | 59 ..... | 84 ..... |
| 10 ..... | 35 ..... | 60 ..... | 85 ..... |
| 11 ..... | 36 ..... | 61 ..... | 86 ..... |
| 12 ..... | 37 ..... | 62 ..... | 87 ..... |
| 13 ..... | 38 ..... | 63 ..... | 88 ..... |
| 14 ..... | 39 ..... | 64 ..... | 89 ..... |
| 15 ..... | 40 ..... | 65 ..... | 90 ..... |
| 16 ..... | 41 ..... | 66 ..... | 91 ..... |
| 17 ..... | 42 ..... | 67 ..... | 92 ..... |
| 18 ..... | 43 ..... | 68 ..... | 93 ..... |
| 19 ..... | 44 ..... | 69 ..... | 94 ..... |
| 20 ..... | 45 ..... | 70 ..... | 95 ..... |
| 21 ..... | 46 ..... | 71 ..... | 96 ..... |
| 22 ..... | 47 ..... | 72 ..... | 97 ..... |
| 23 ..... | 48 ..... | 73 ..... | 98 ..... |
| 24 ..... | 49 ..... | 74 ..... | 99 ..... |
| 25 ..... | 50 ..... | 75 ..... | 100..... |

The numbers that are circled are called .....

What do these numbers have in common? .....

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Question to Discuss: Why isn't the number 1 considered to be a Prime Number?