Times Tables 4U

Four Step Programme

Improve Your Times Tables Skills Now

– **Student Workbook** –

With Alan Young

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ACTIVITIES

Introduction

Welcome to the Times Tables 4U ***Four Step Programme*** to mastering your multiplication tables.

There are three levels at which you can begin depending on your age and which tables you already know.

If you feel embarrassed in class because you do not know your tables as well as you should, or if you find it difficult to do the mathematics work your teachers give you because this lack of knowledge makes it difficult for you to tackle problems, then spend some time working the ***Four Step Programme*** and before you know it, you will have a much better knowledge of tables and you will be able to recall them much better when tackling your school work.

There is a Parents' Handbook that accompanies this workbook and your parents will explain how to tackle the work in the right order to give you back your confidence and enable you to enjoy maths lessons.

I have taught a great many students from the very youngest to those taking their GCSE examinations at 16 years old and far too many of them have problems with tables which hold them up time and time again.

It's a bit like learning to ride a bike – once you can ride one you never forget how to. And once you have learnt your tables really well you will always know them and that will make your maths work so much easier.

Once you have learnt all ten tables really well, you will find a number of activities at the end of this workbook you can tackle. These are all based around tables work and so you should not be using a calculator to tackle them except where the instructions say you can, but they will also help you with the work you are tackling at school at the moment or work you will cover in the future, so have a go at as many of them as you can manage.

I have to say that some are pretty hairy and if you are quite young you may need some help from a parent, especially with the reading, but don't let that put you off.

In just a few months' time, you could be top of the class!

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LEVEL 1

Assessment Table Square

×	2	1	5	10
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No	Time
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Record of Times for Table Squares

	No. 1	Time:		
×	5	2	1	10
9				
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8				
4				
7				
1				
6				
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	No. 2	Time:		
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	No. 3	Time:		
×	2	5	10	1
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	No. 4	Time:		
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	No. 5	Time:		
×	10	1	5	2
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2				
5				
8				
6				
9				
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	No. 6	Time:		
×	1	2	10	5
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8				
9				
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	No. 7	Time:		
×	2	10	1	5
8				
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6				
1				
9				
5				
10				
3				
4				

	No. 8	Time:		
×	5	2	10	1
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	No. 9	Time:		
×	1	5	2	10
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	No. 10	Time:		
×	10	5	1	2
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	No. 11	Time:		
×	2	1	5	10
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	No. 12	Time:		
×	10	2	5	1
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	No. 13	Time:		
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	No. 14	Time:		
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7				

	No. 15	Time:		
×	1	5	10	2
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8				
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	No. 16	Time:		
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8				
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	No. 17	Time:		
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	No. 18	Time:		
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	No. 19	Time:		
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1				
10				
6				

	No. 20	Time:		
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5				
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	No. 21	Time:		
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5				

	No. 22	Time:		
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4				
3				
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2				
9				
5				
6				
7				
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	No. 23	Time:		
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9				
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	No. 24	Time:		
×	2	1	5	10
4				
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	No. 25	Time:		
×	2	1	5	10
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	No. 26	Time:		
×	5	10	2	1
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4				
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3				
10				

	No. 27	Time:		
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1				
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10				

	No. 28	Time:		
×	2	10	1	5
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4				
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7				
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6				

	No. 29	Time:		
×	5	1	10	2
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9				
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	No. 30	Time:		
×	5	1	2	10
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10				
1				
6				
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9				
4				
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8				

	No. 31	Time:		
×	10	2	1	5
7				
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6				
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8				
3				
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5				
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	No. 32	Time:		
×	1	5	2	10
10				
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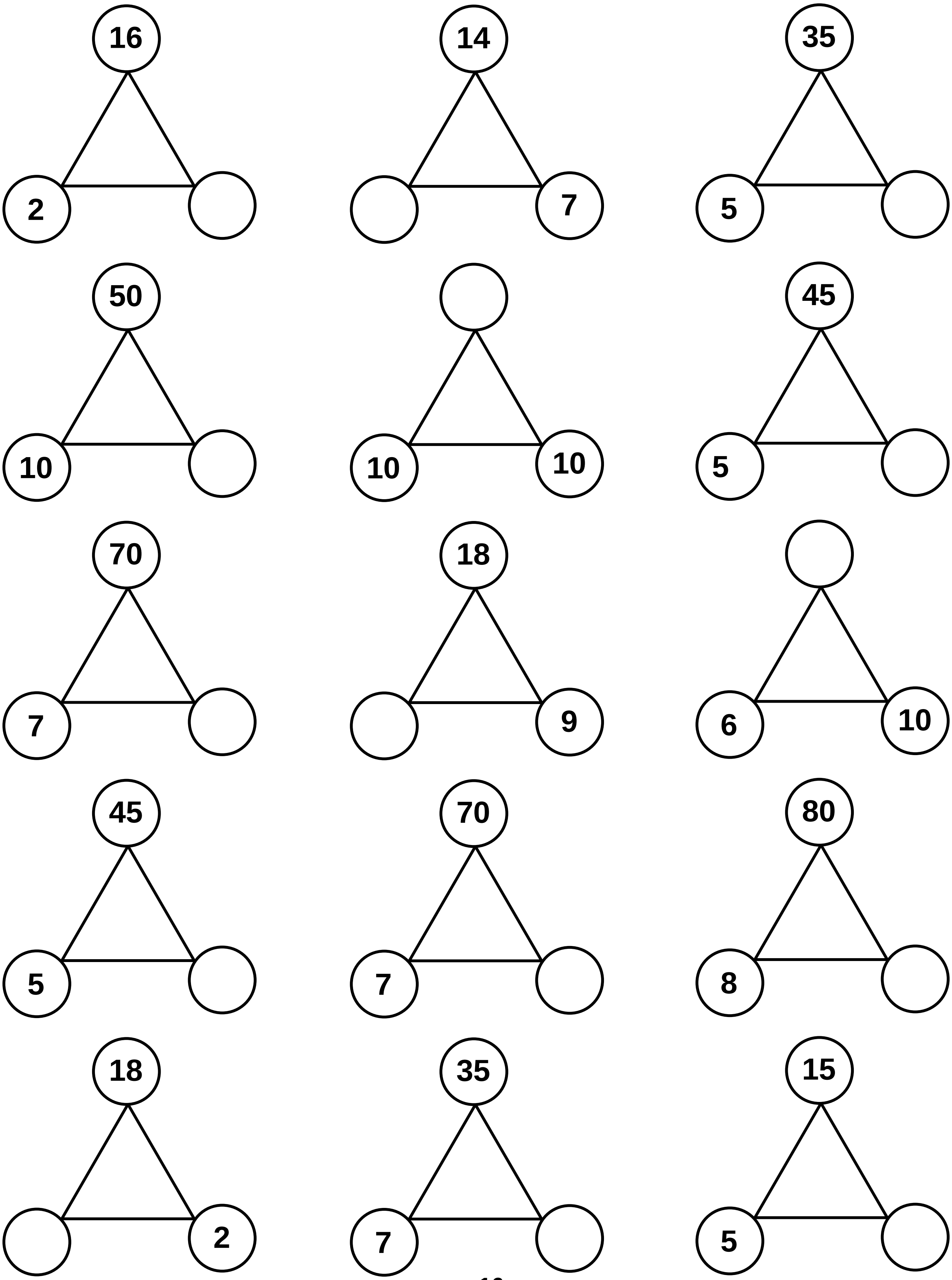
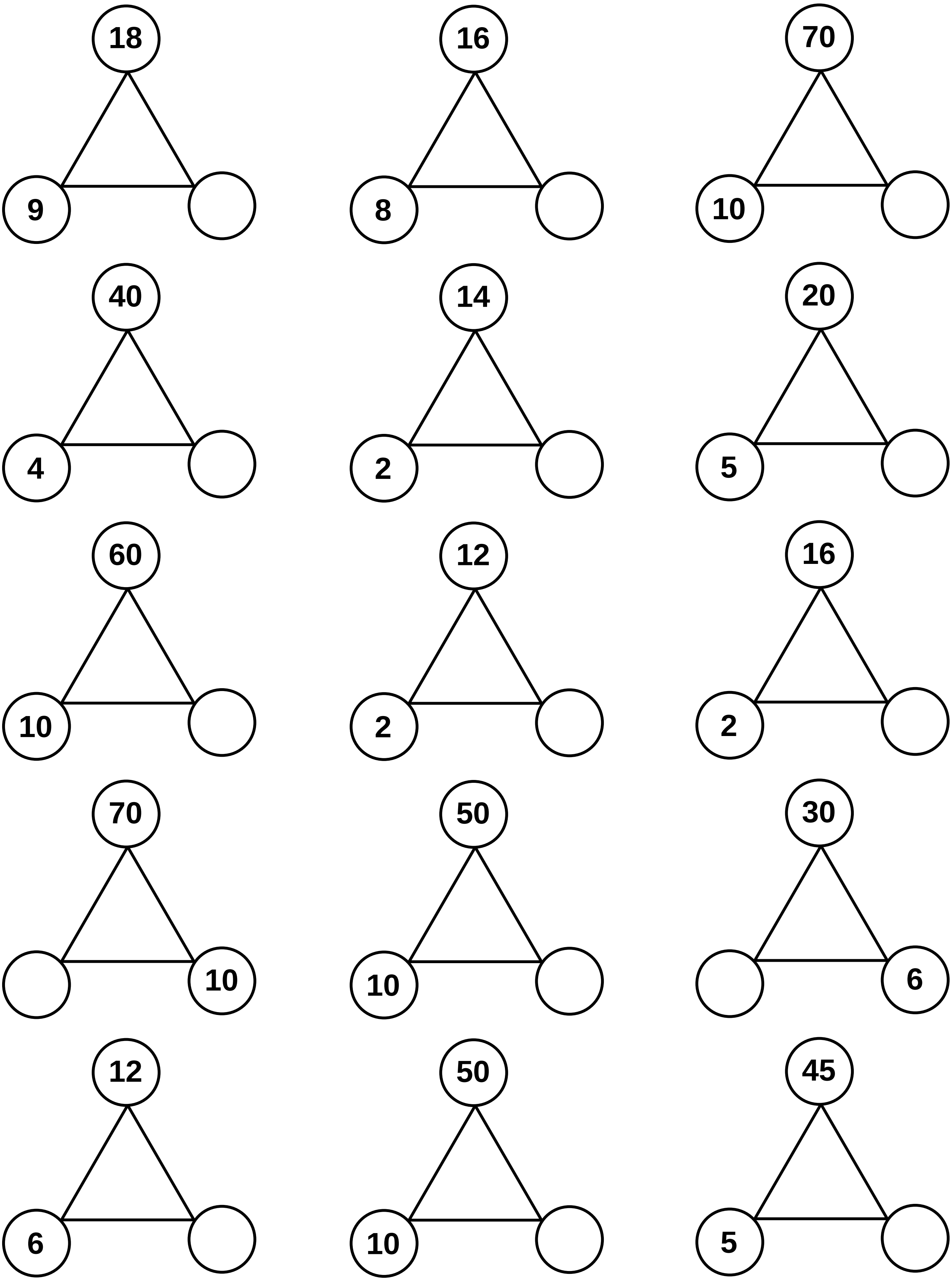
Times Table Triangles

The top number in each triangle is the bottom two numbers multiplied together. Fill in the empty circles.

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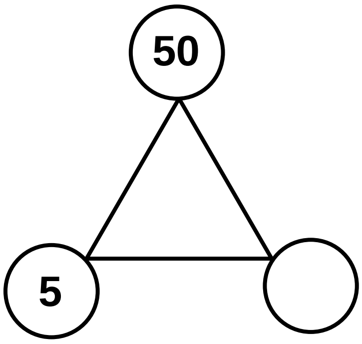
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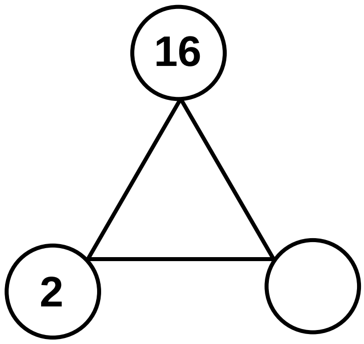
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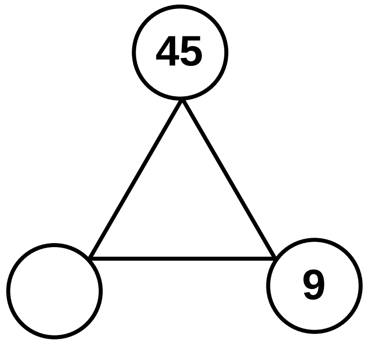
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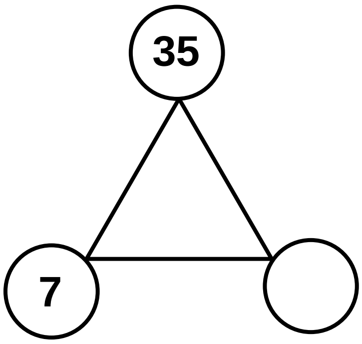
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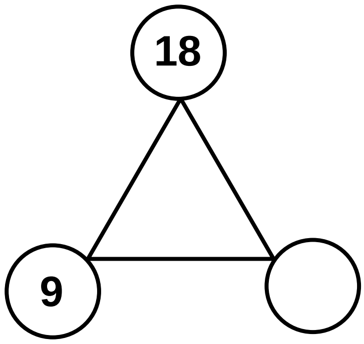
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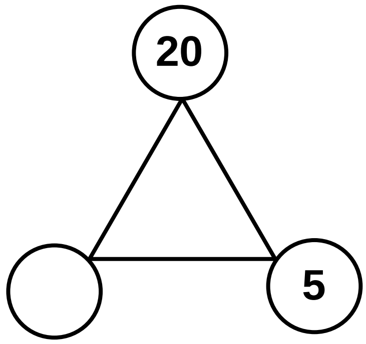
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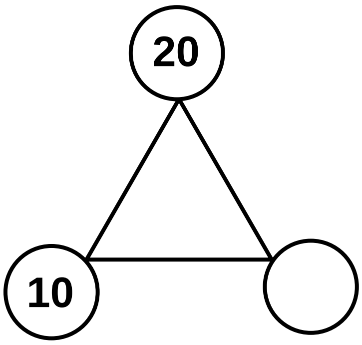
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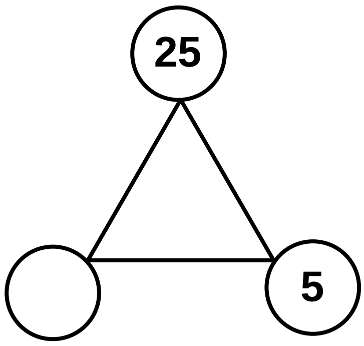
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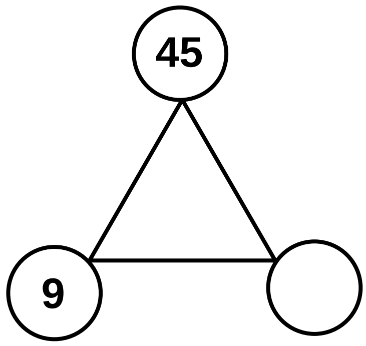
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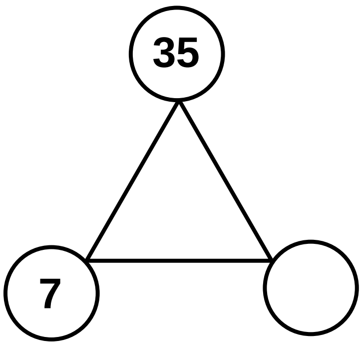
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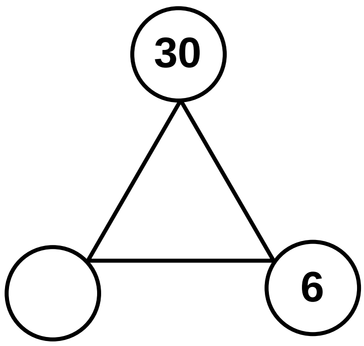
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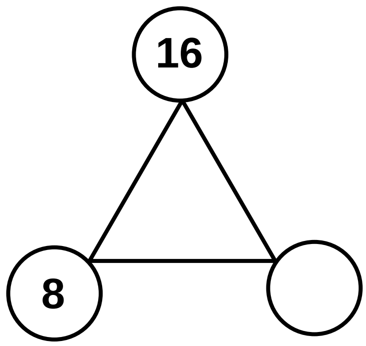
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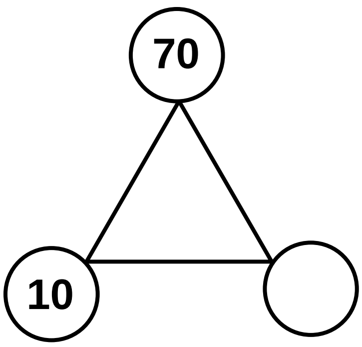
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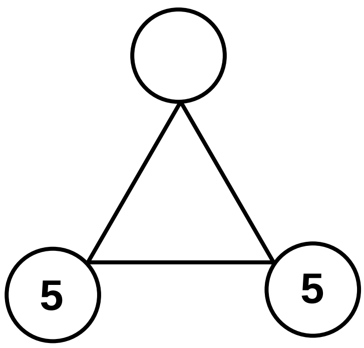
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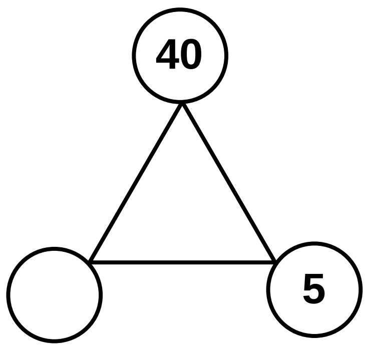
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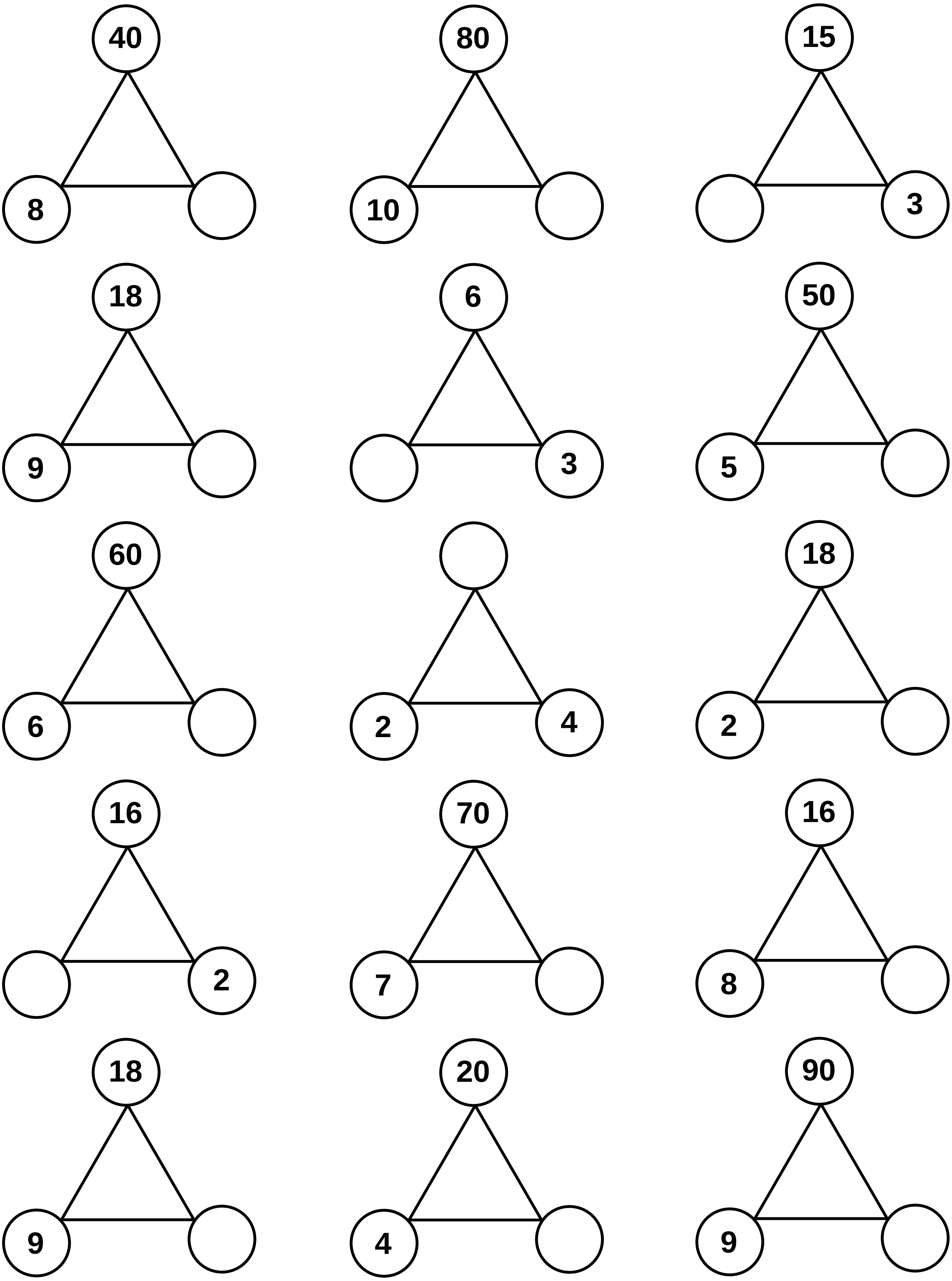
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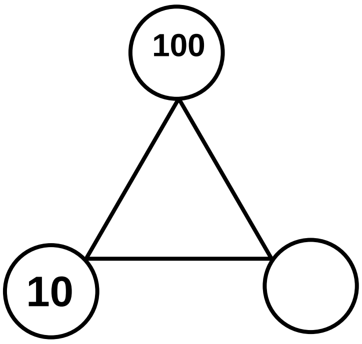
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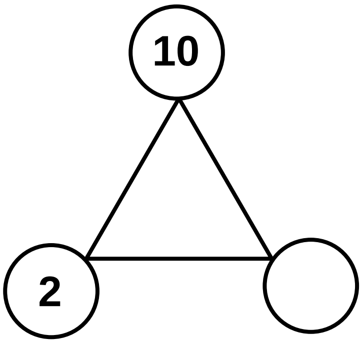
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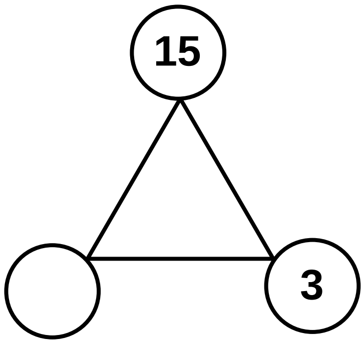
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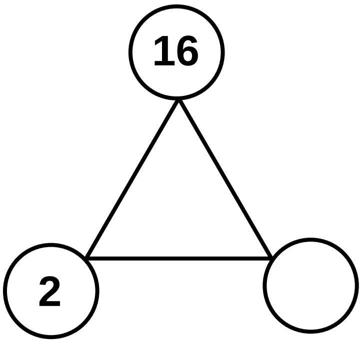
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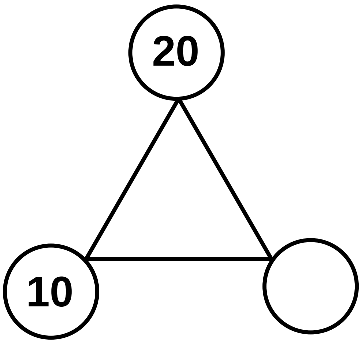
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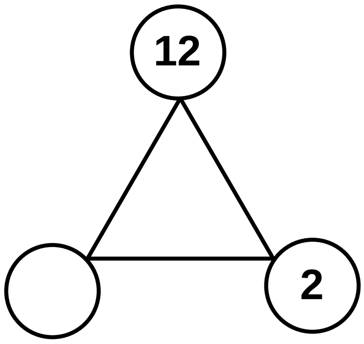
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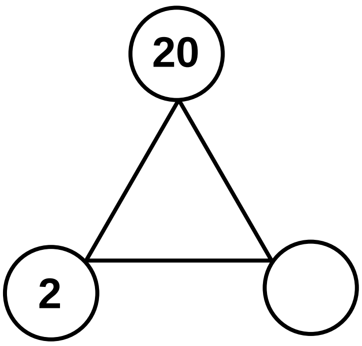
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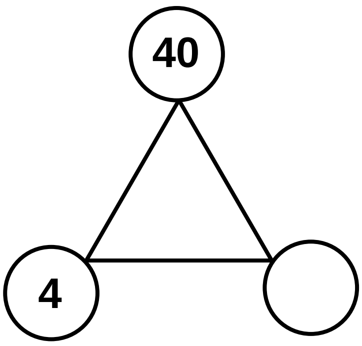
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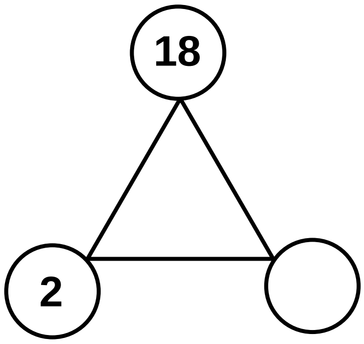
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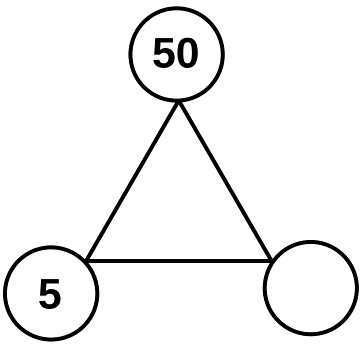
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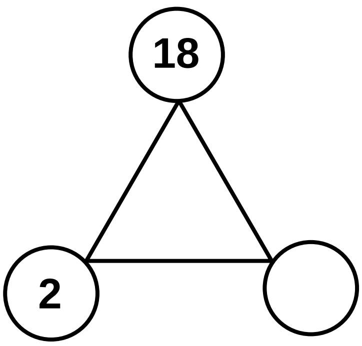
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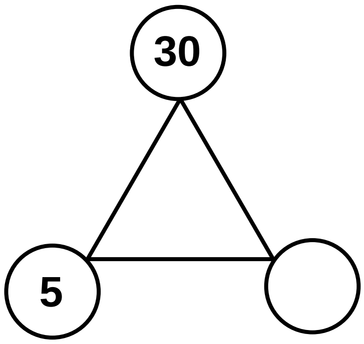
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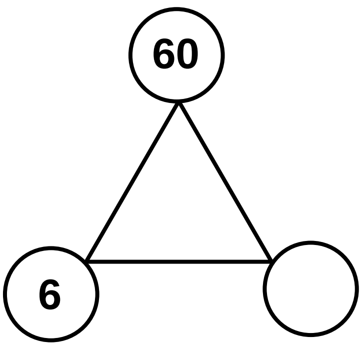
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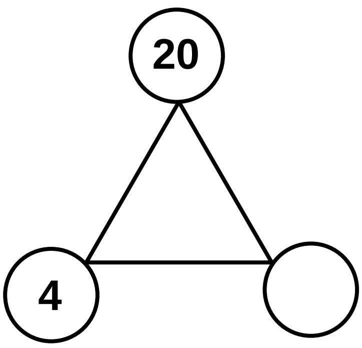
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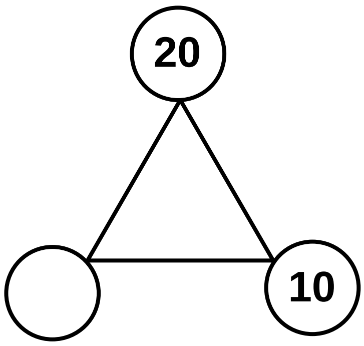
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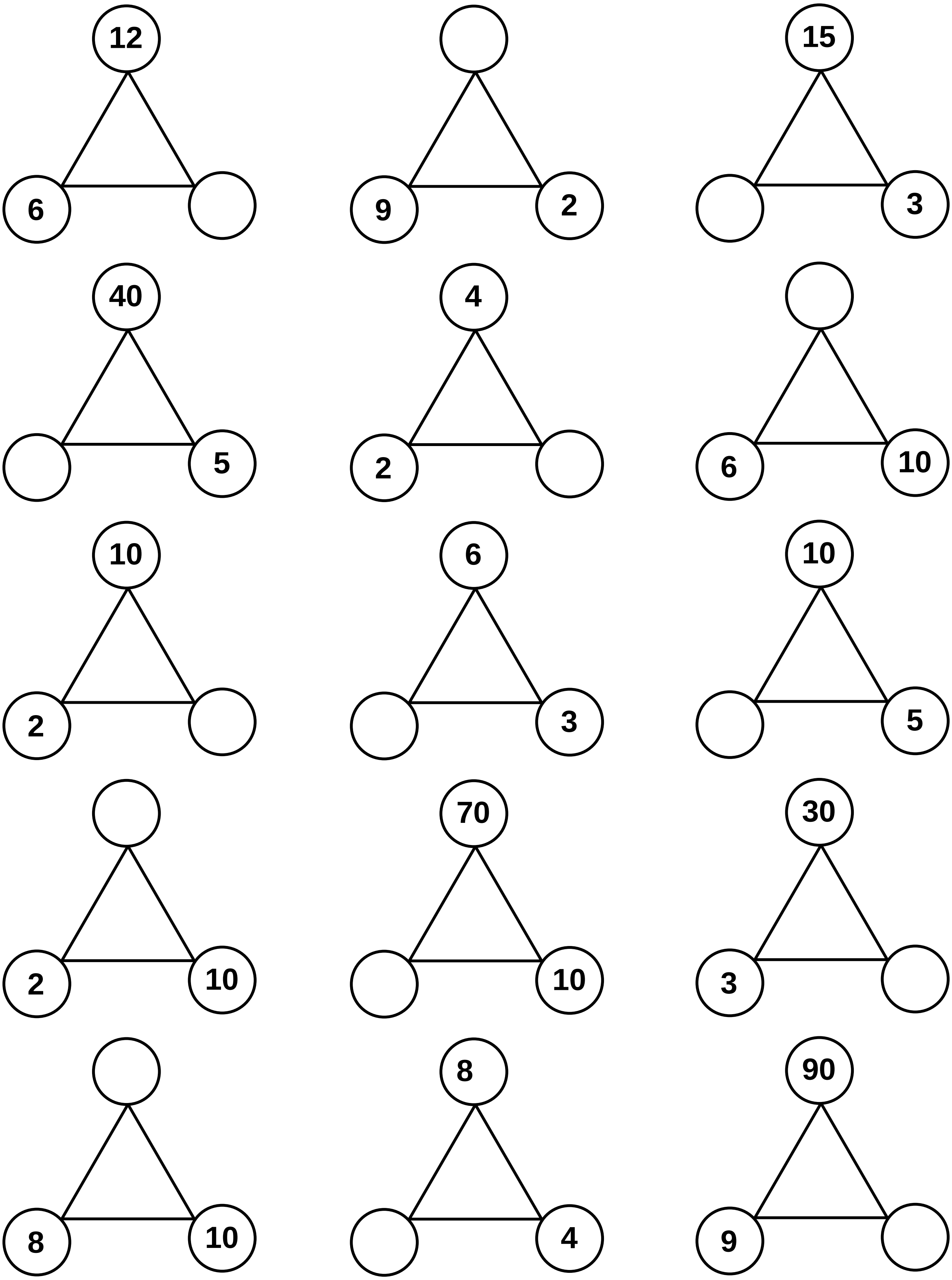
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70
10
30
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8
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8
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90
9

LEVEL 2

Assessment Table Square

×	5	2	10	1	3	6	4
2							
7							
1							
6							
10							
3							
8							
4							
5							
9							

No	Time		No	Time
1			33	
2			34	
3			35	
4			36	
5			37	
6			38	
7			39	
8			40	
9			41	
10			42	
11			43	
12			44	
13			45	
14			46	
15			47	
16			48	
17			49	
18			50	
19			51	
20			52	
21			53	
22			54	
23			55	
24			56	
25			57	
26			58	
27			59	
28			60	
29			61	
30			62	
31			63	
32			64	

Record of Times for Table Squares

	No. 1		Time:				
×	3	6	2	1	4	5	10
3							
10							
2							
5							
6							
1							
8							
4							
9							
7							

	No. 2		Time:				
×	6	1	5	2	4	10	3
3							
9							
8							
2							
7							
10							
1							
5							
4							
6							

	No. 3		Time:				
×	1	10	4	5	2	6	3
3							
9							
2							
8							
7							
1							
10							
6							
4							
5							

	No. 4		Time:				
×	10	3	1	6	2	4	5
2							
10							
9							
3							
1							
7							
6							
4							
8							
5							

	No. 5	Time:					
×	4	10	3	6	2	1	5
8							
7							
2							
6							
1							
9							
5							
10							
3							
4							

	No. 6	Time:					
×	2	6	1	3	10	4	5
5							
3							
2							
7							
10							
6							
1							
9							
4							
8							

	No. 7	Time:					
×	4	1	6	3	5	10	2
2							
7							
6							
1							
5							
4							
8							
9							
3							
10							

	No. 8	Time:					
×	1	10	2	6	3	5	4
4							
10							
3							
7							
2							
5							
8							
6							
9							
1							

	No. 9		Time:				
×	6	4	1	5	3	10	2
4							
9							
8							
3							
5							
7							
2							
6							
10							
1							

	No. 10		Time:				
×	5	1	4	2	6	3	10
5							
4							
10							
3							
6							
1							
7							
8							
9							
2							

	No. 11		Time:				
×	3	6	4	2	10	5	1
4							
10							
3							
7							
5							
2							
6							
9							
1							
8							

	No. 12		Time:				
×	1	6	2	10	3	4	5
9							
3							
2							
8							
7							
6							
1							
10							
4							
5							

	No. 13		Time:				
×	1	5	2	10	3	4	6
10							
9							
5							
7							
3							
6							
4							
2							
8							
1							

	No. 14		Time:				
×	3	1	4	10	2	5	6
9							
3							
10							
2							
5							
8							
1							
7							
4							
6							

	No. 15		Time:				
×	4	3	10	2	1	5	6
3							
1							
7							
2							
6							
10							
4							
5							
8							
9							

	No. 16		Time:				
×	10	4	1	5	2	6	3
4							
9							
10							
3							
5							
8							
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	No. 20		Time:				
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2							

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6							

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	No. 33	Time:					
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4							
5							

	No. 34	Time:					
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10							

	No. 35	Time:					
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	No. 36	Time:					
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1							

	No. 59	Time:					
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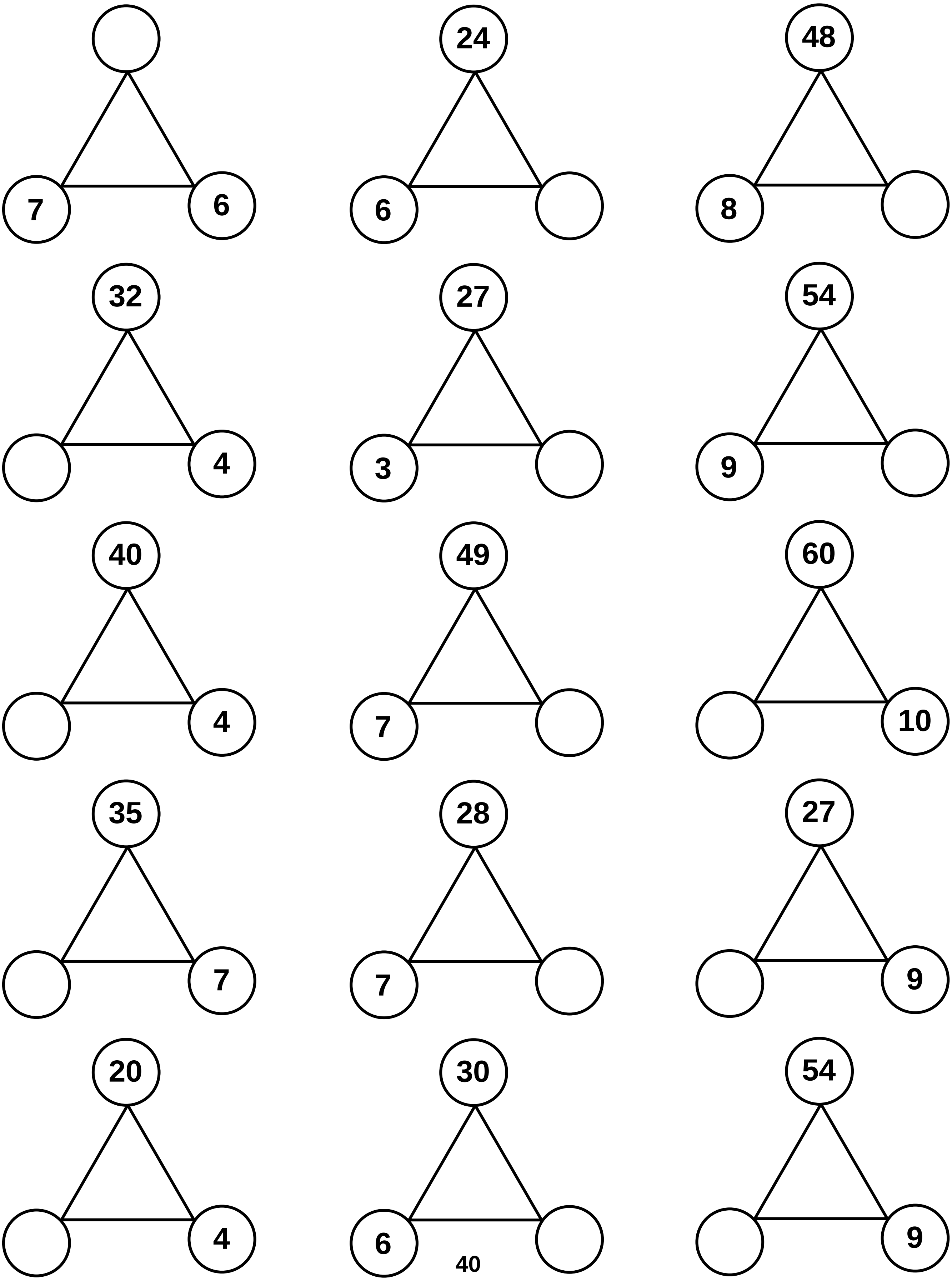
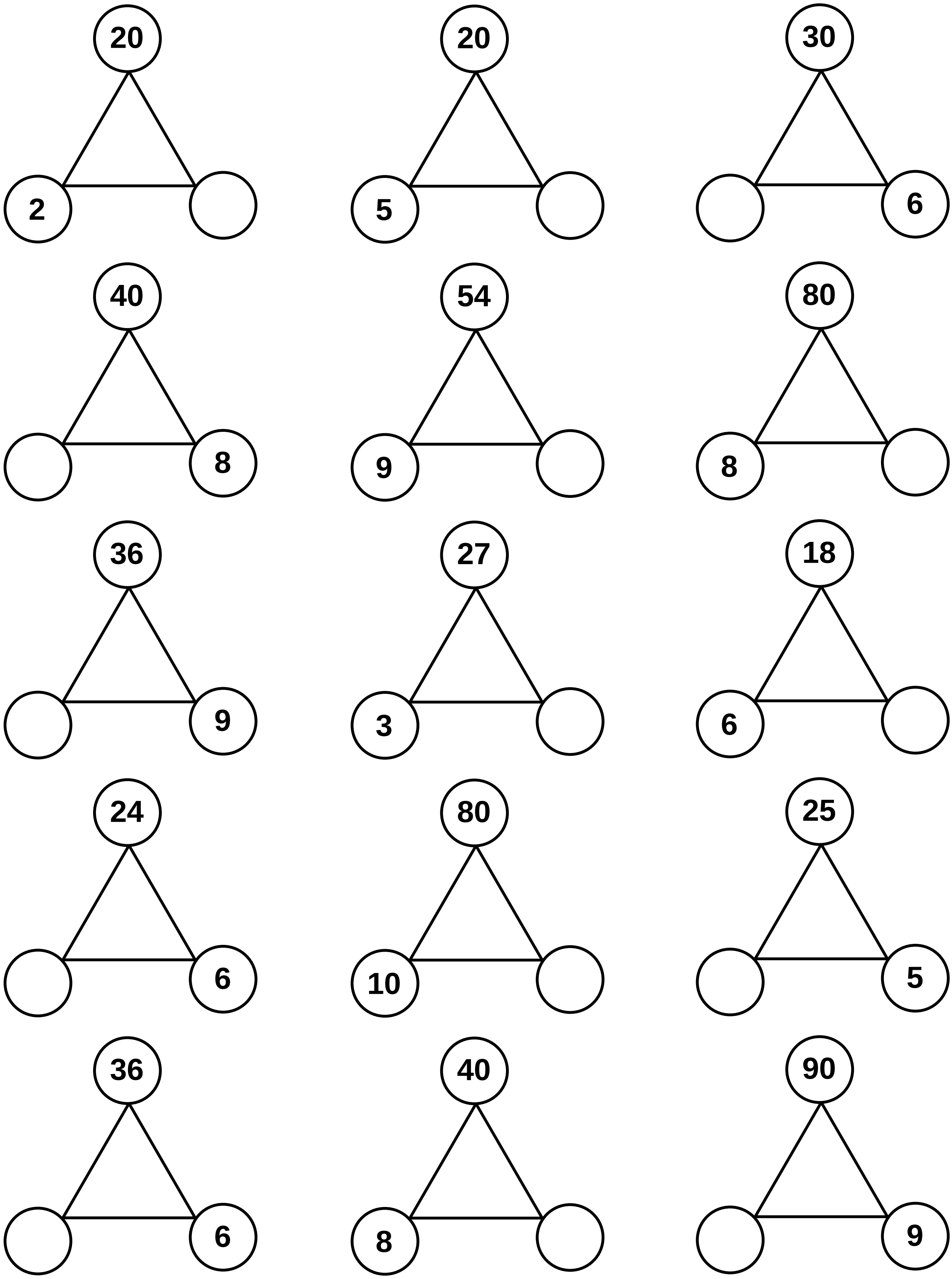
Times Table Triangles

The top number in each triangle is the bottom two numbers multiplied together. Fill in the empty circles.

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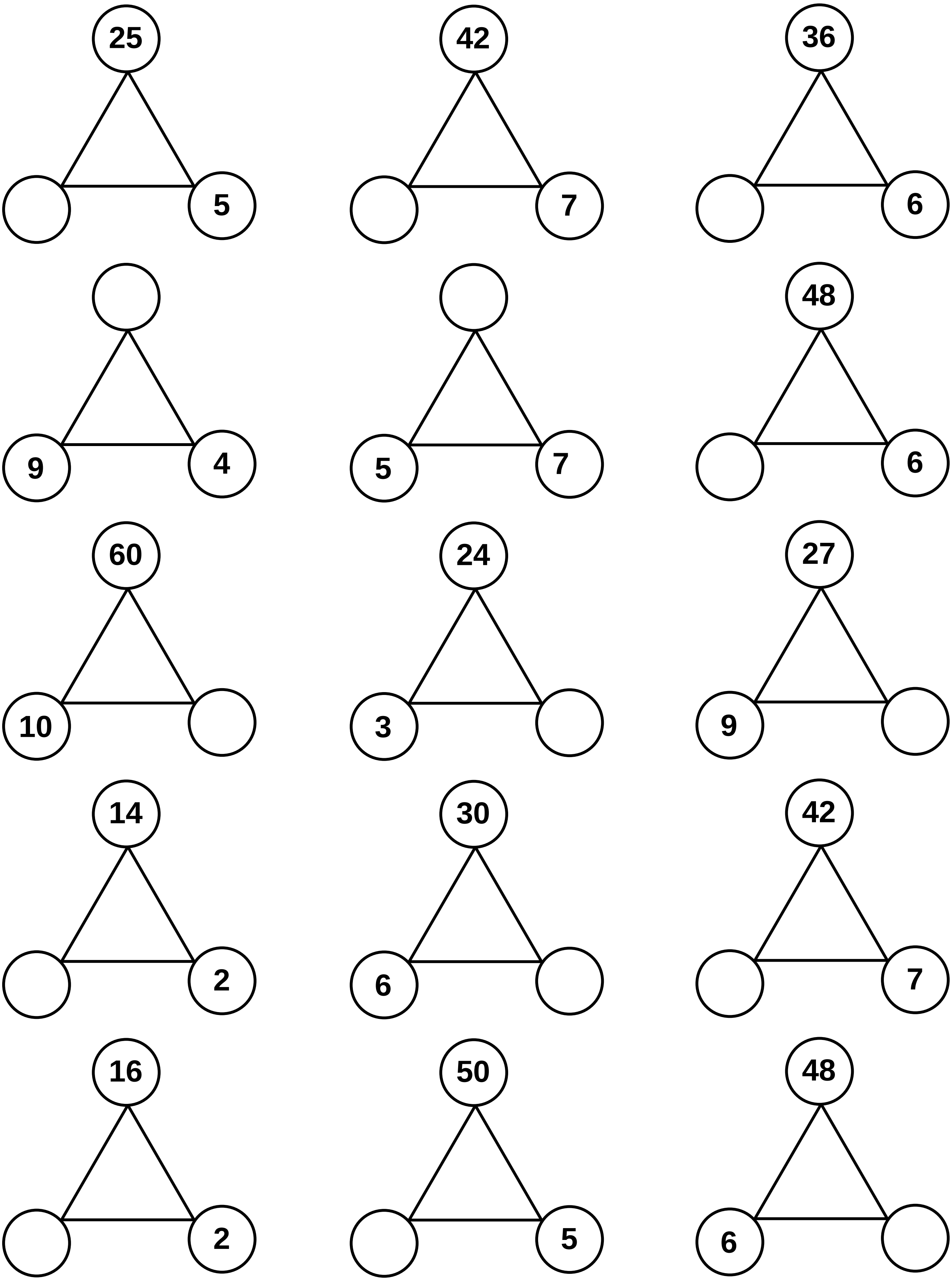
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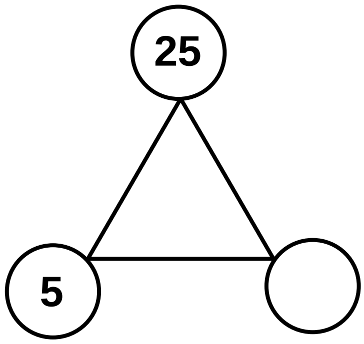
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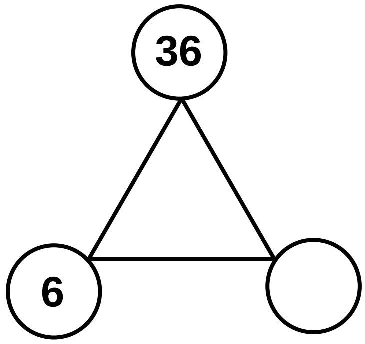
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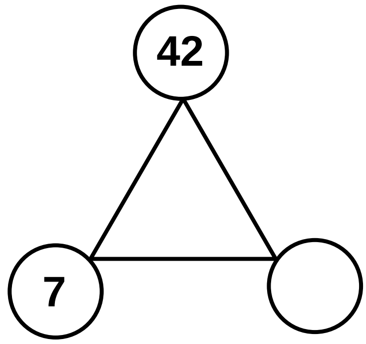
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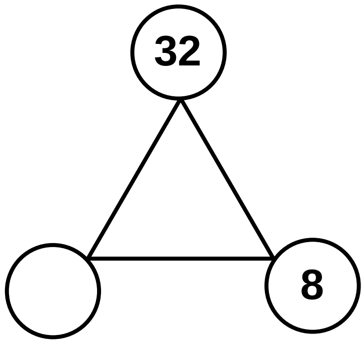
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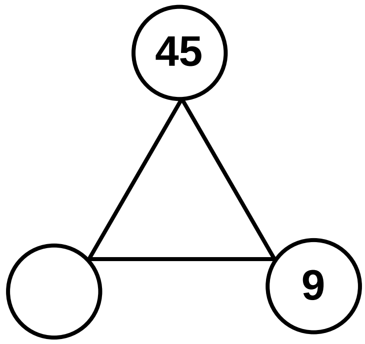
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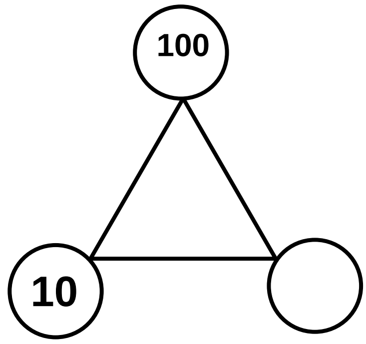
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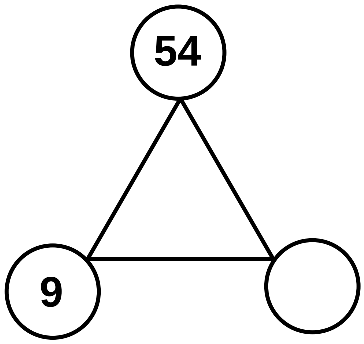
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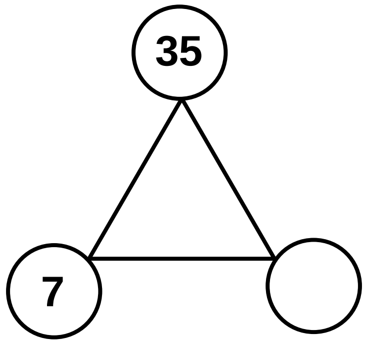
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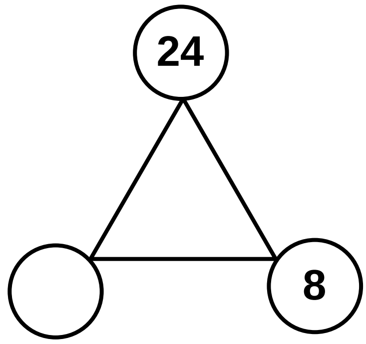
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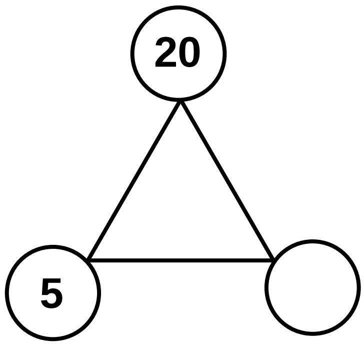
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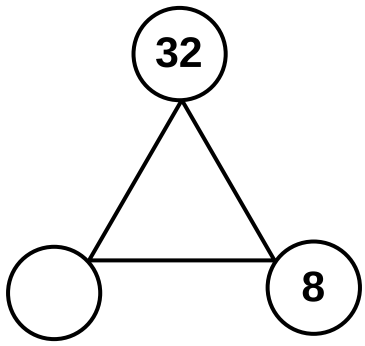
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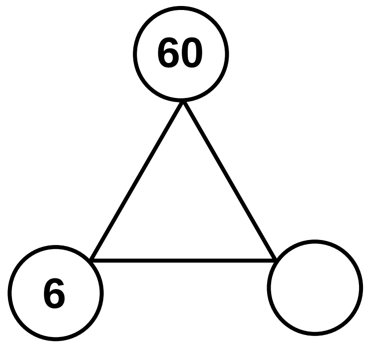
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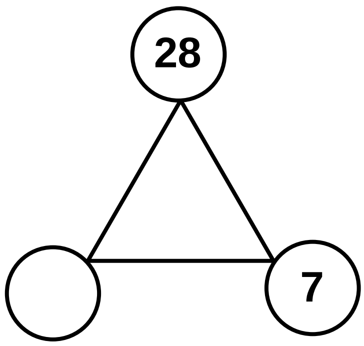
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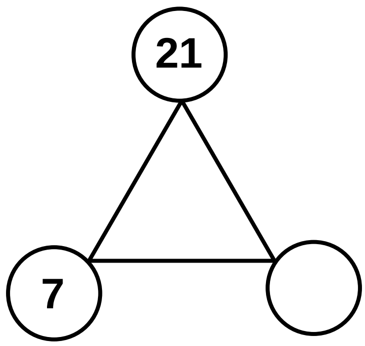
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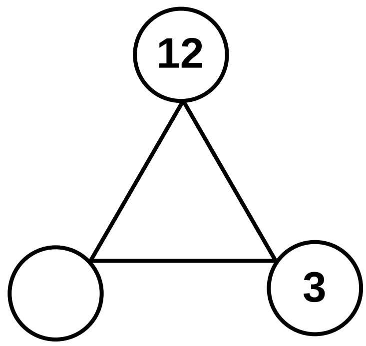
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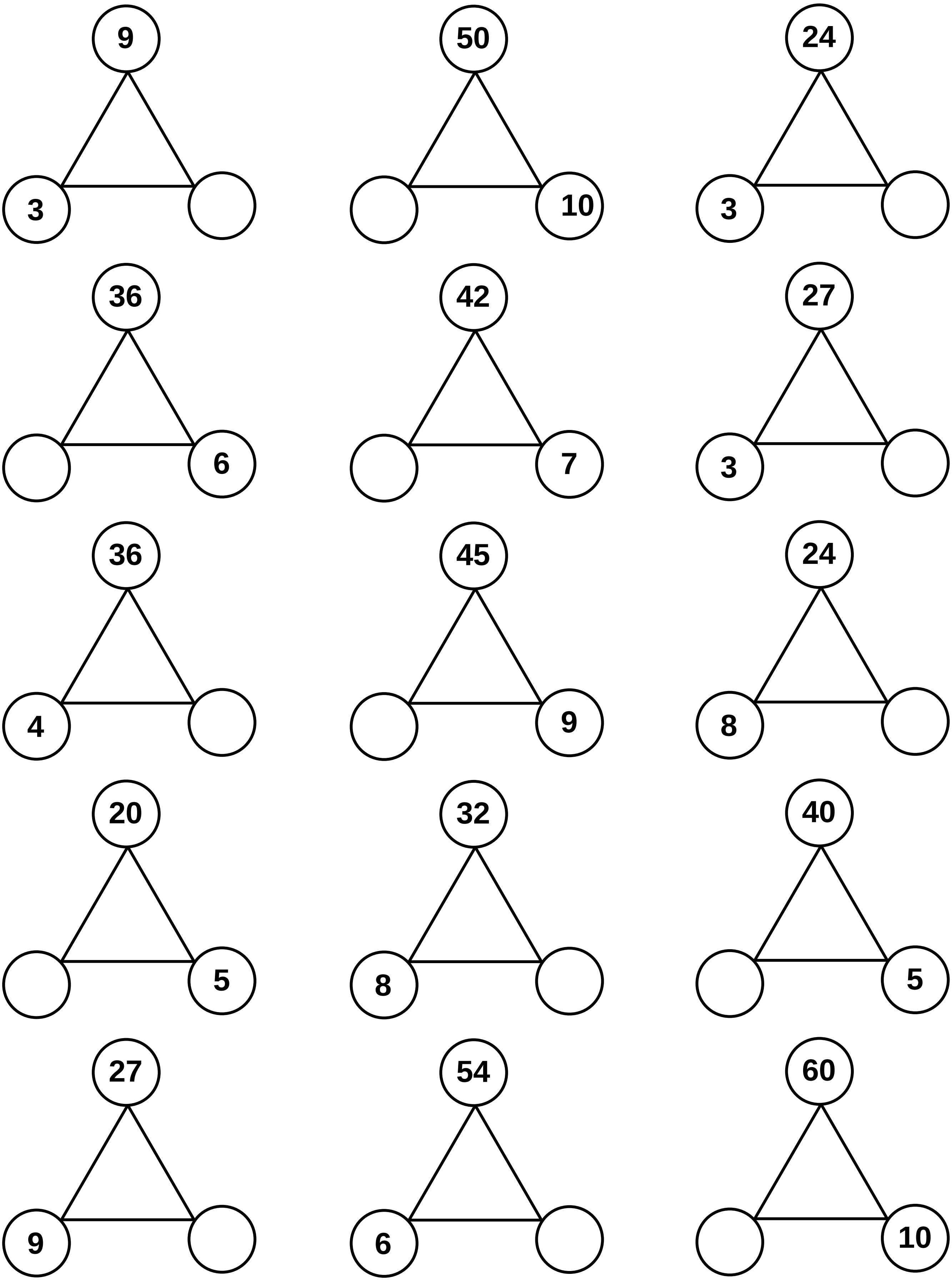
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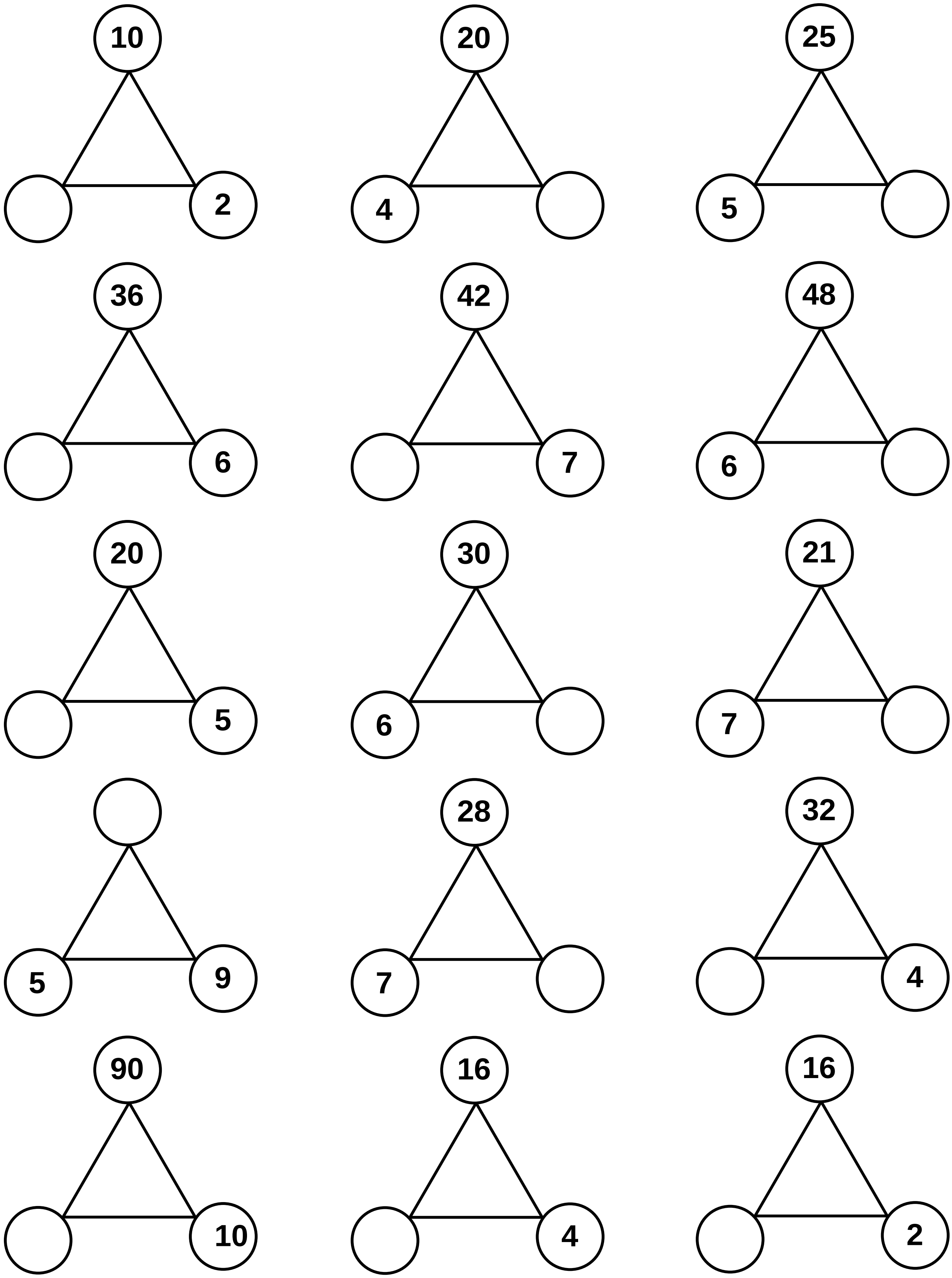
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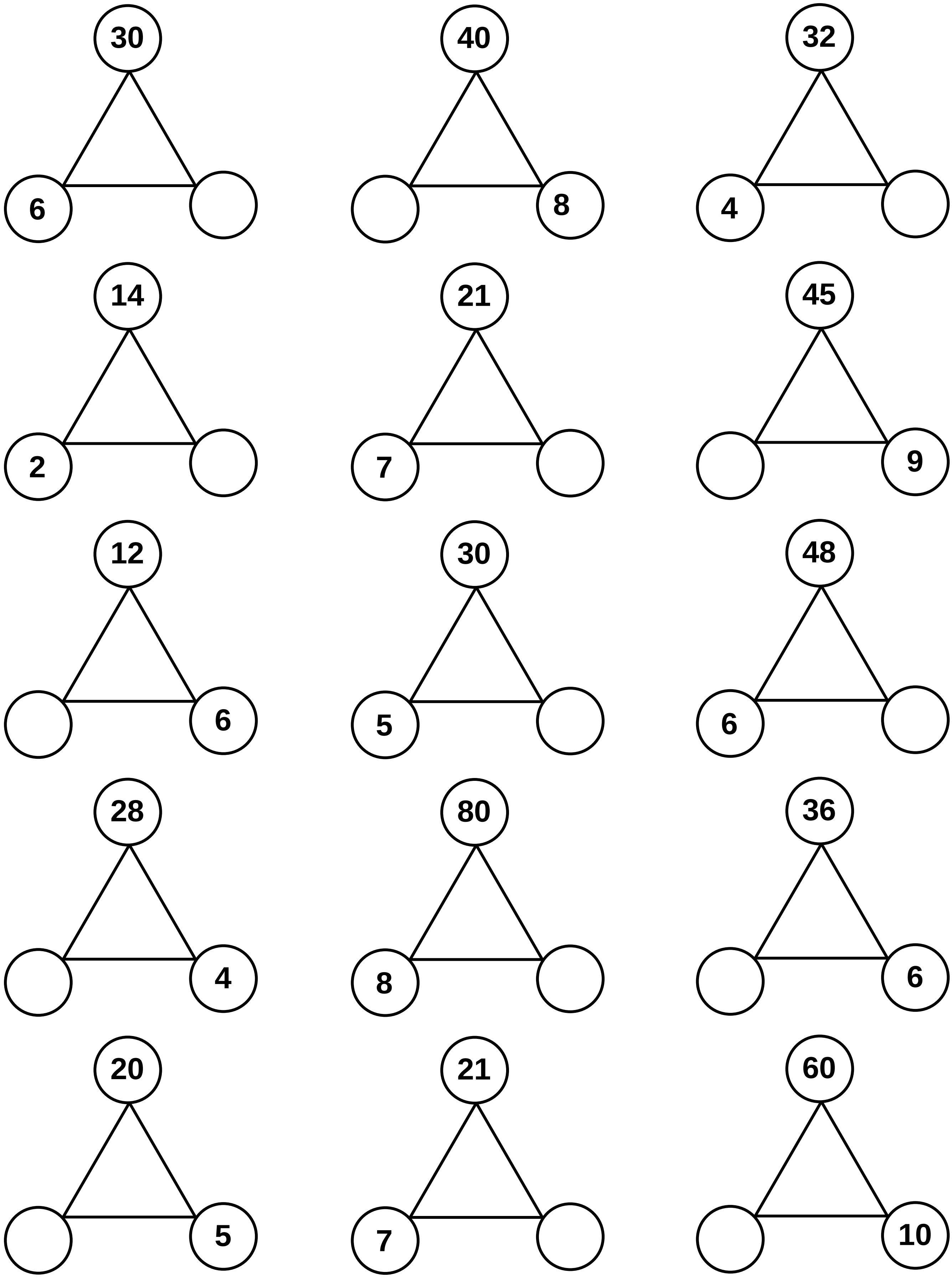
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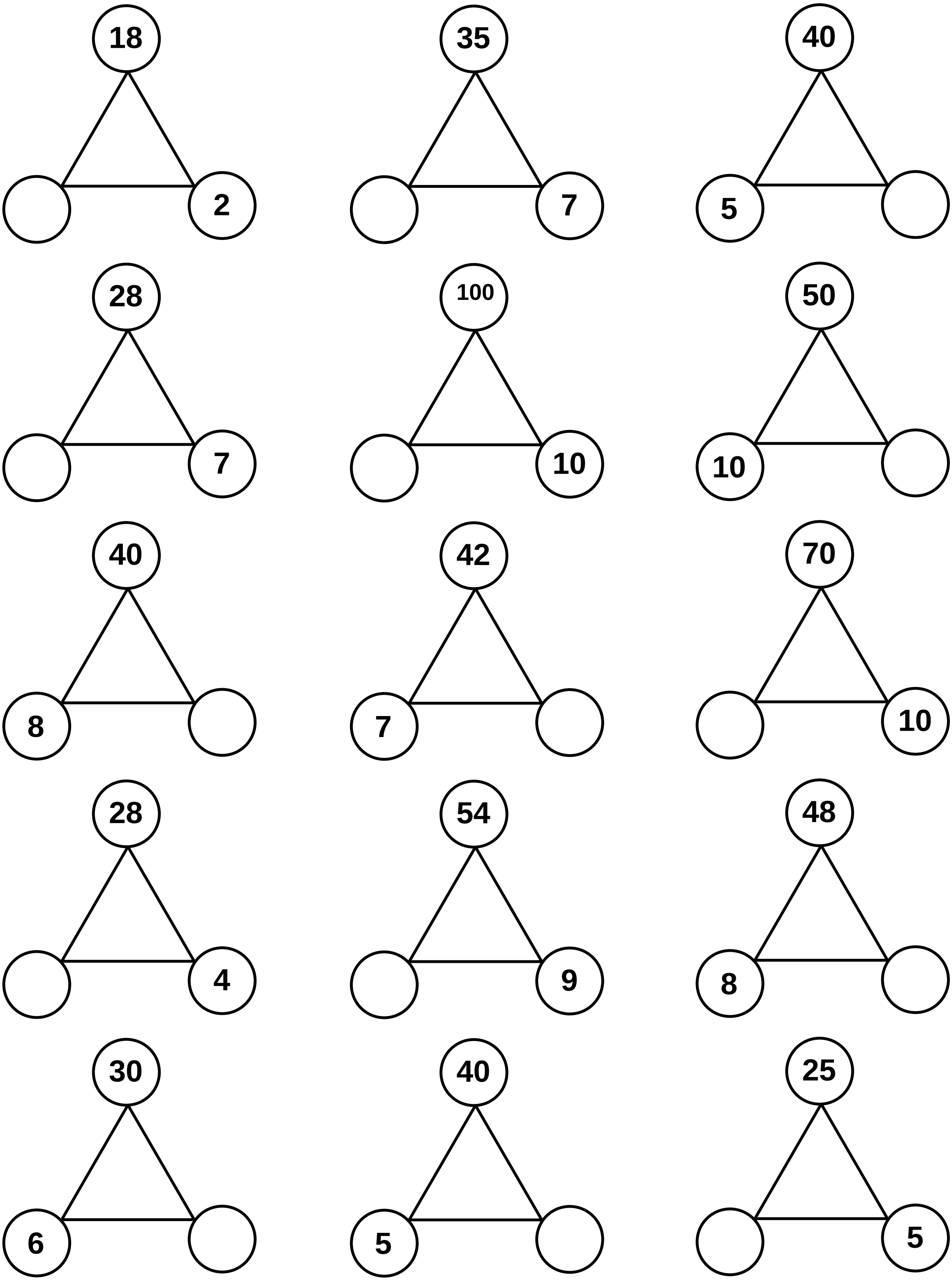
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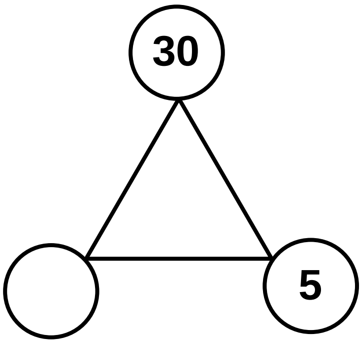
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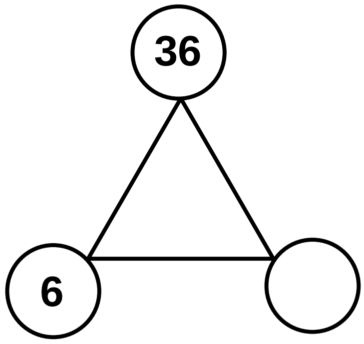
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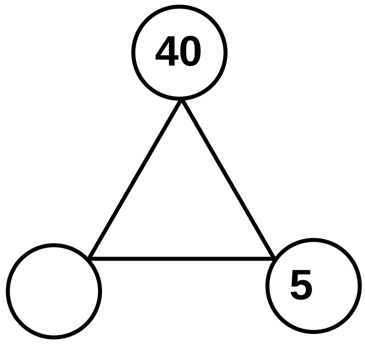
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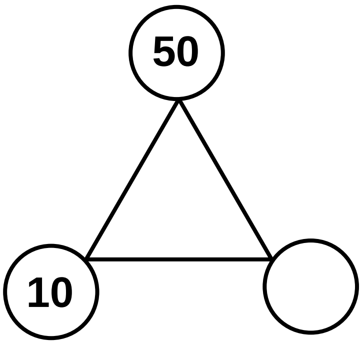
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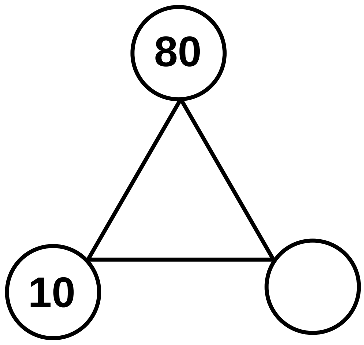
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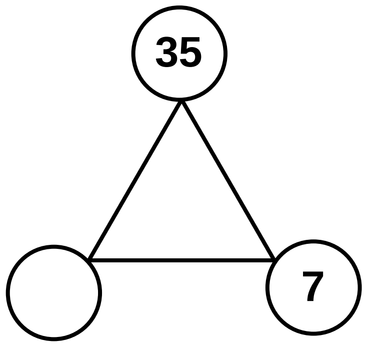
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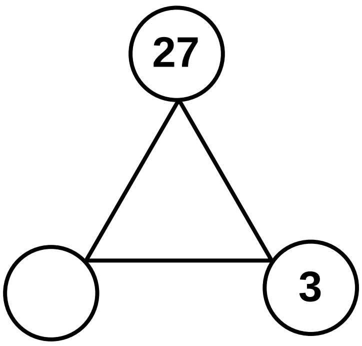
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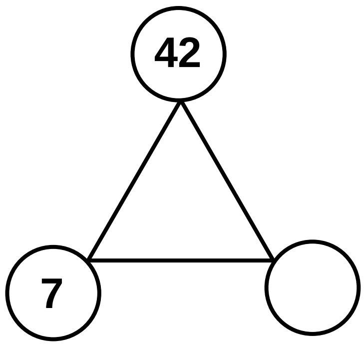
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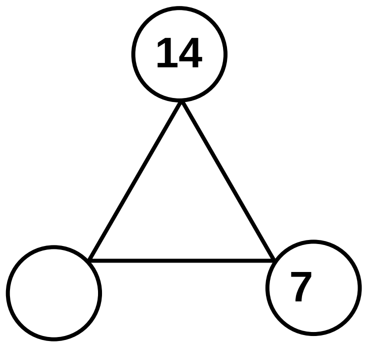
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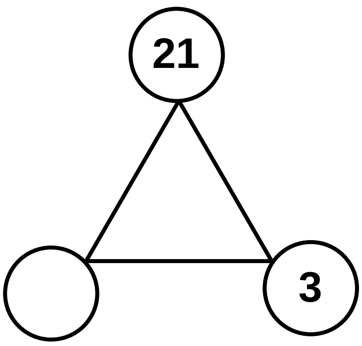
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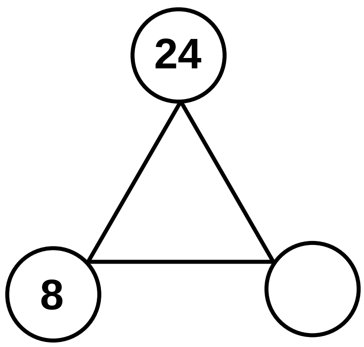
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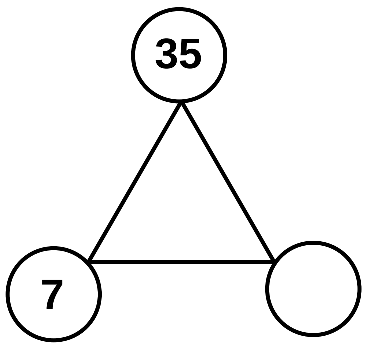
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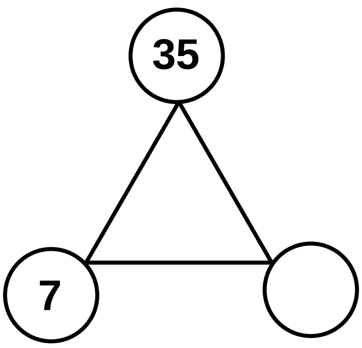
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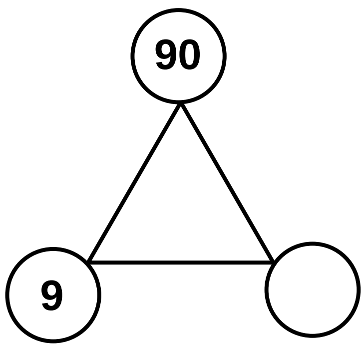
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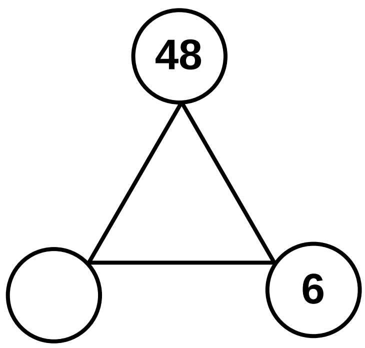
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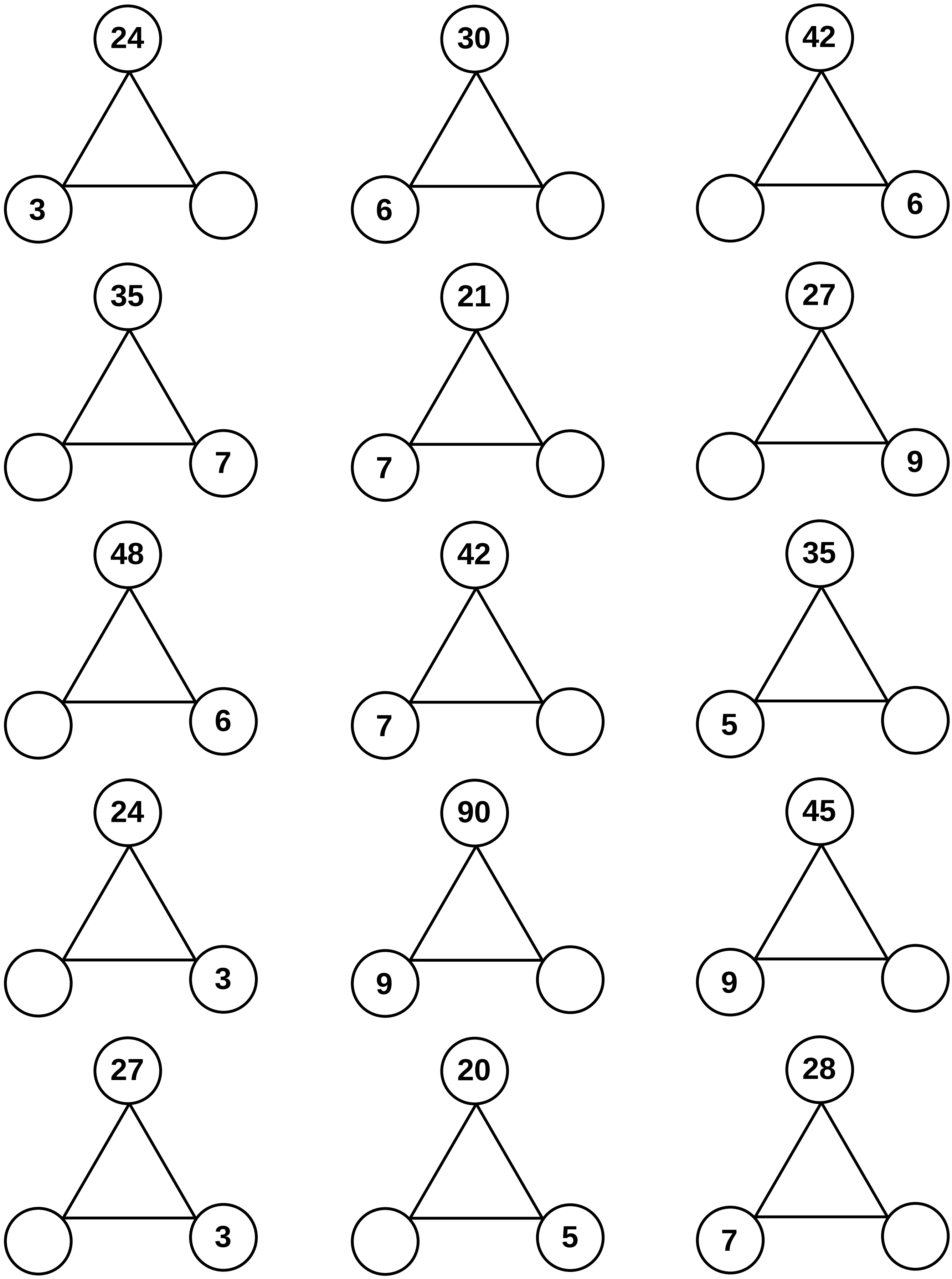
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LEVEL 3

Assessment Table Square

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No	Time	No	Time	No	Time
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2		34		66	
3		35		67	
4		36		68	
5		37		69	
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14		46		78	
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16		48		80	
17		49		81	
18		50		82	
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23		55		87	
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27		59		91	
28		60		92	
29		61		93	
30		62		94	
31		63		95	
32		64		96	

Record of Times for Table Squares

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	No. 55			Time:						
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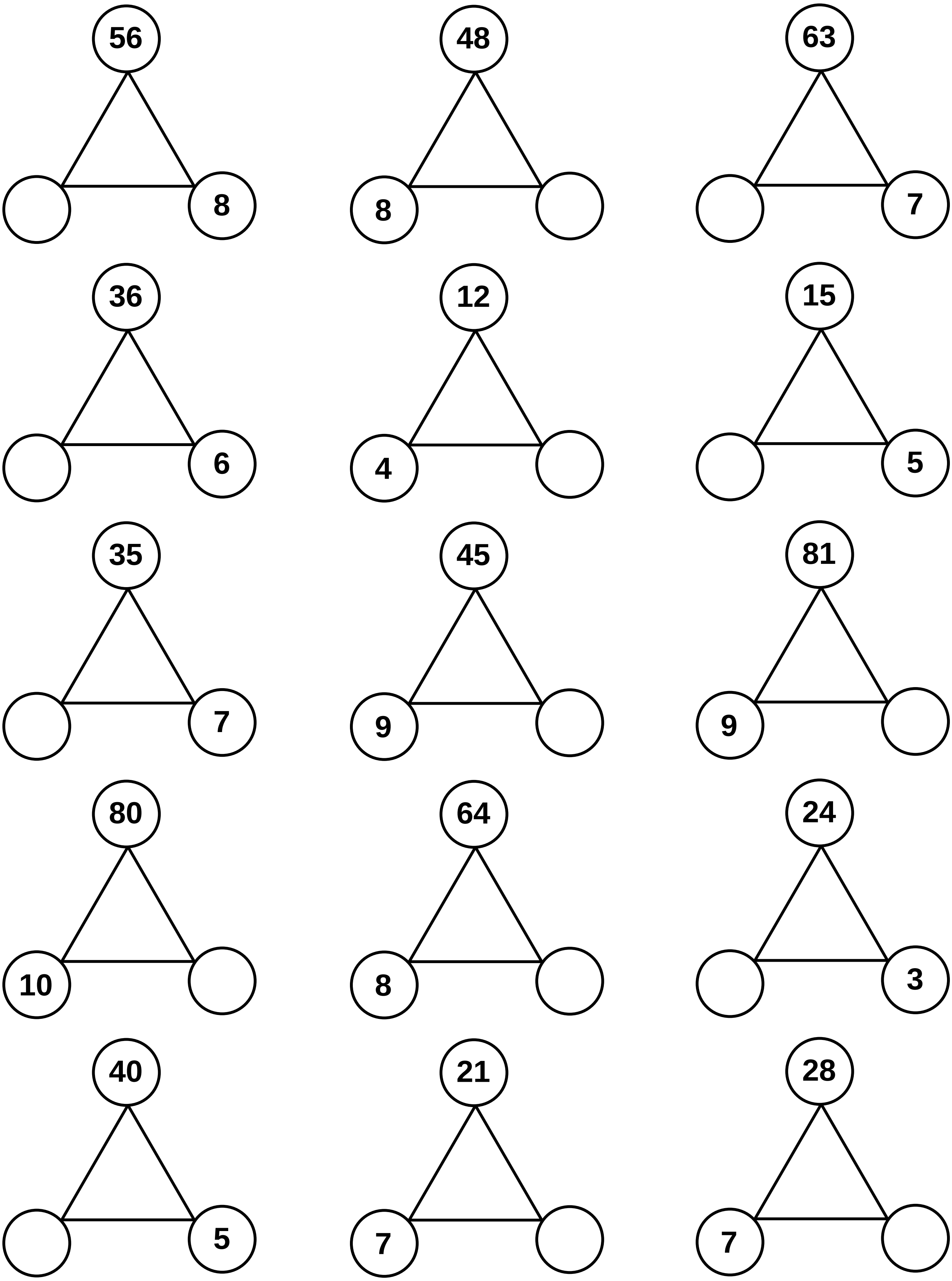
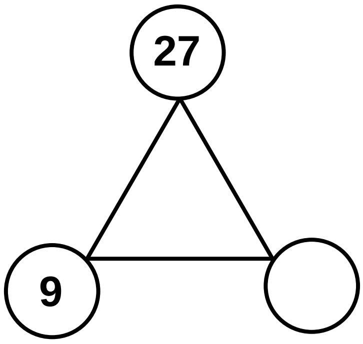
Times Table Triangles

The top number in each triangle is the bottom two numbers multiplied together. Fill in the empty circles.

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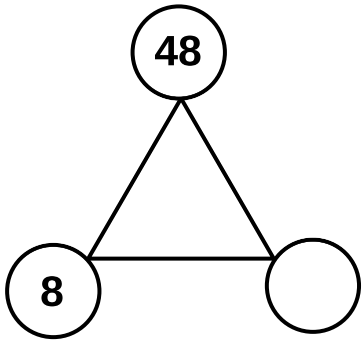
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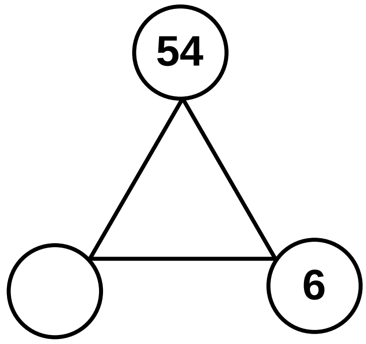
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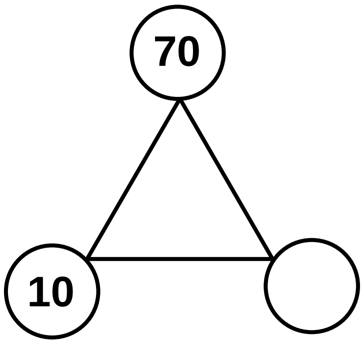
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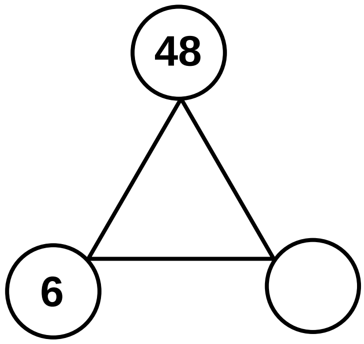
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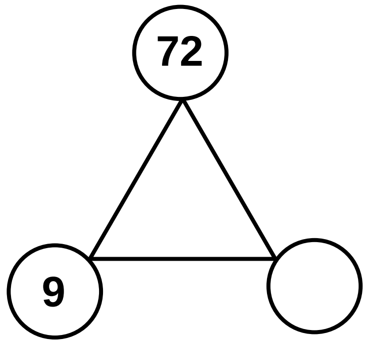
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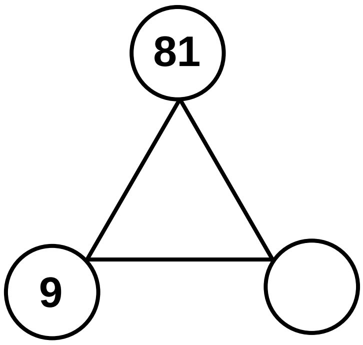
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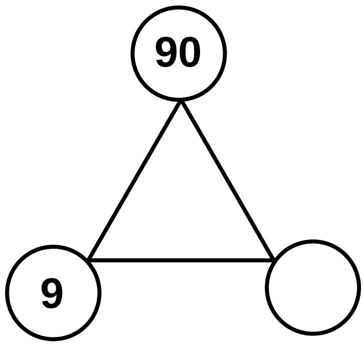
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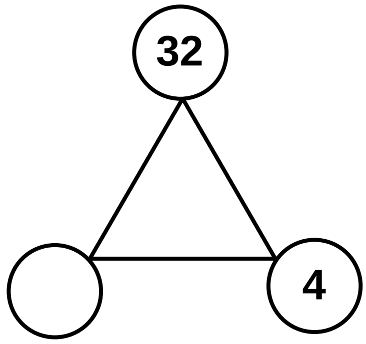
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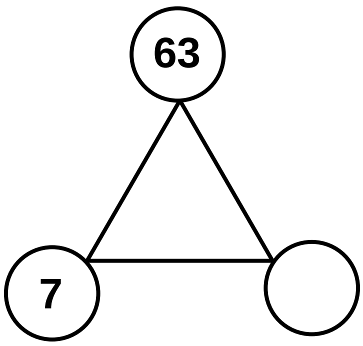
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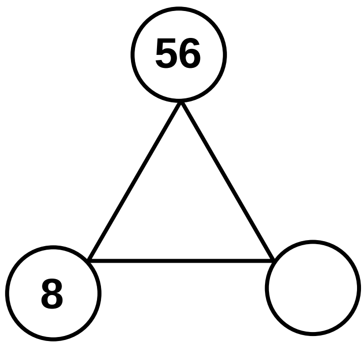
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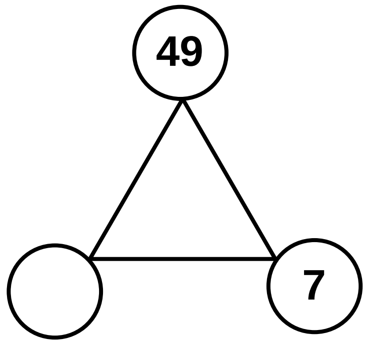
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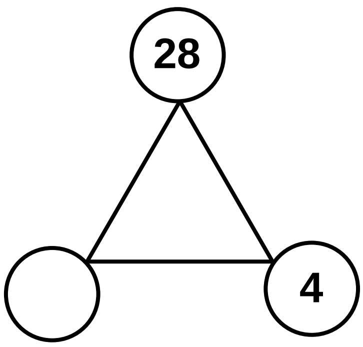
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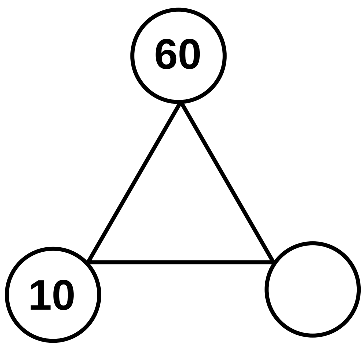
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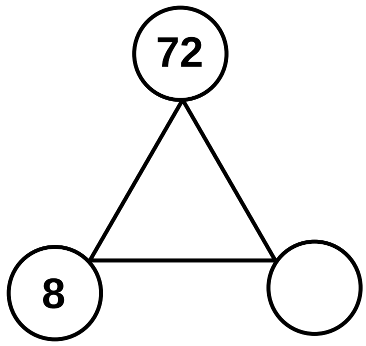
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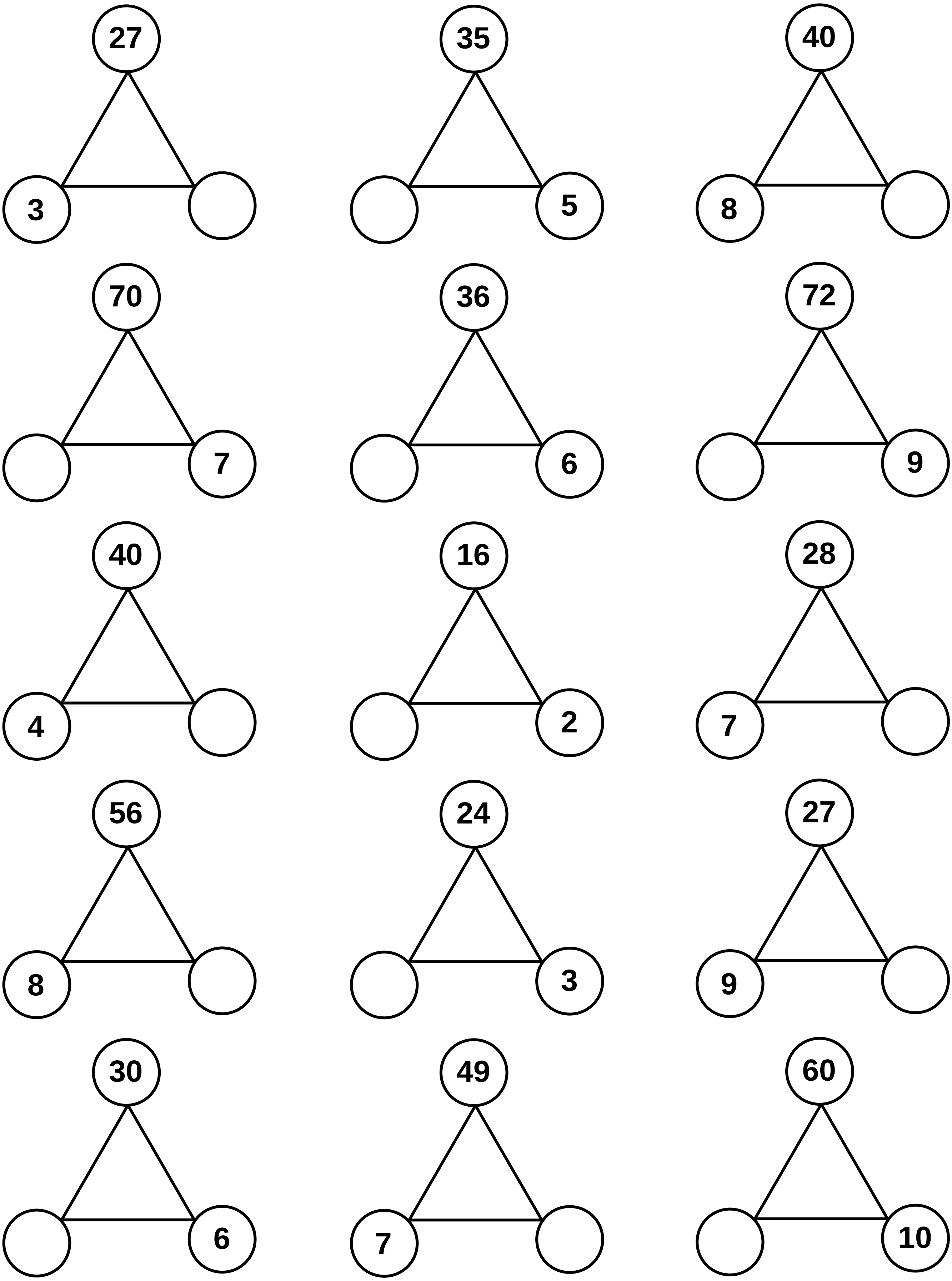
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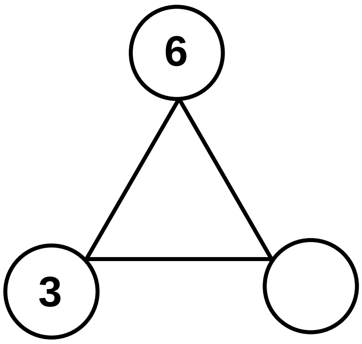
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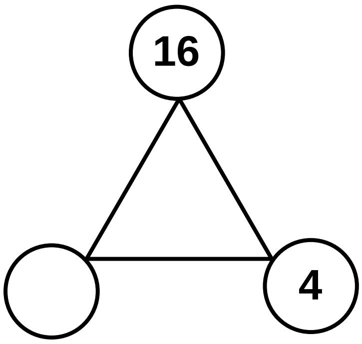
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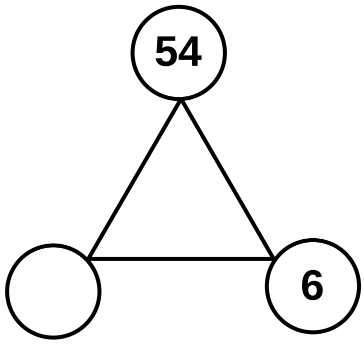
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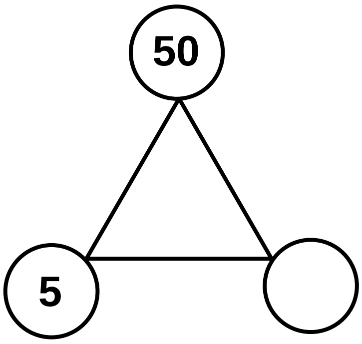
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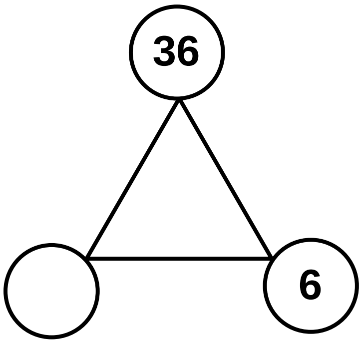
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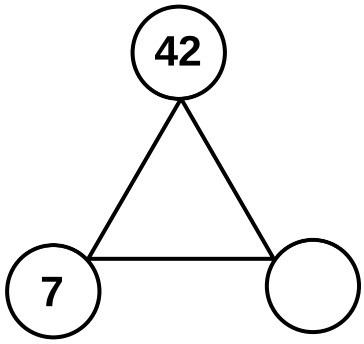
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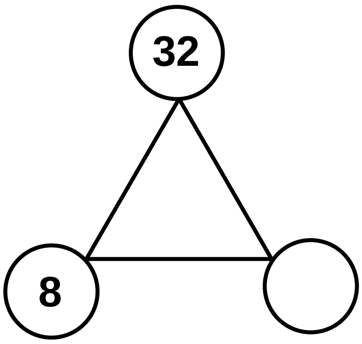
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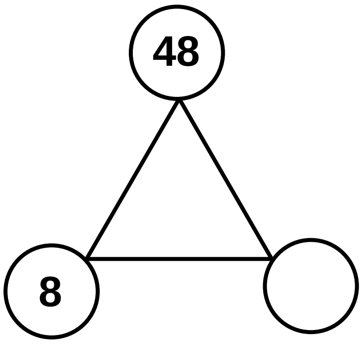
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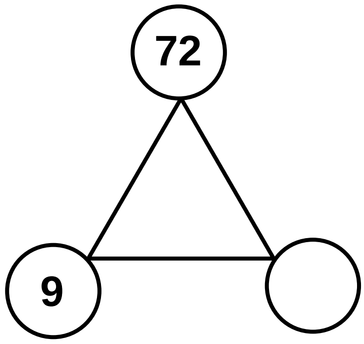
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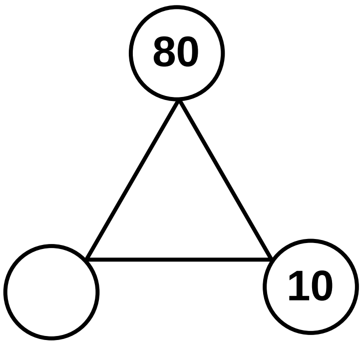
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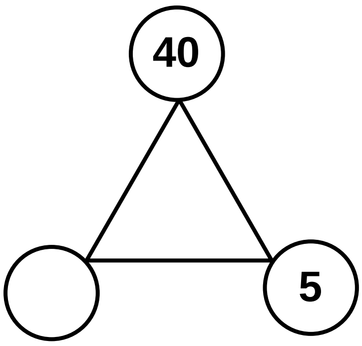
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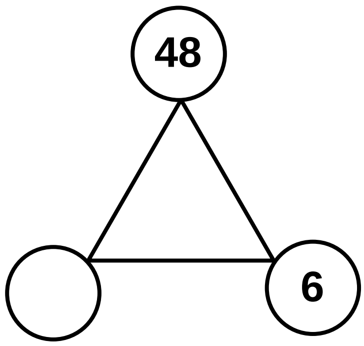
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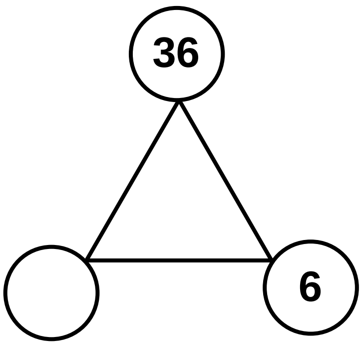
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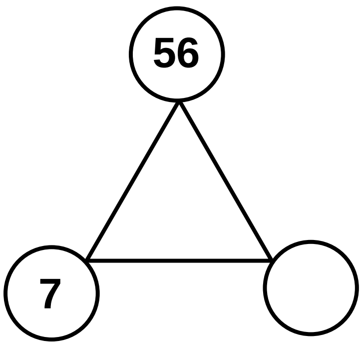
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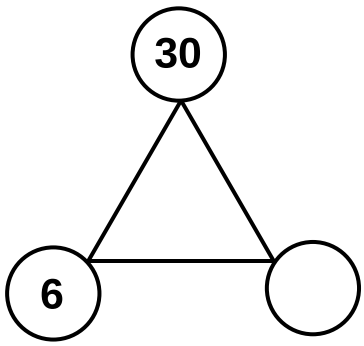
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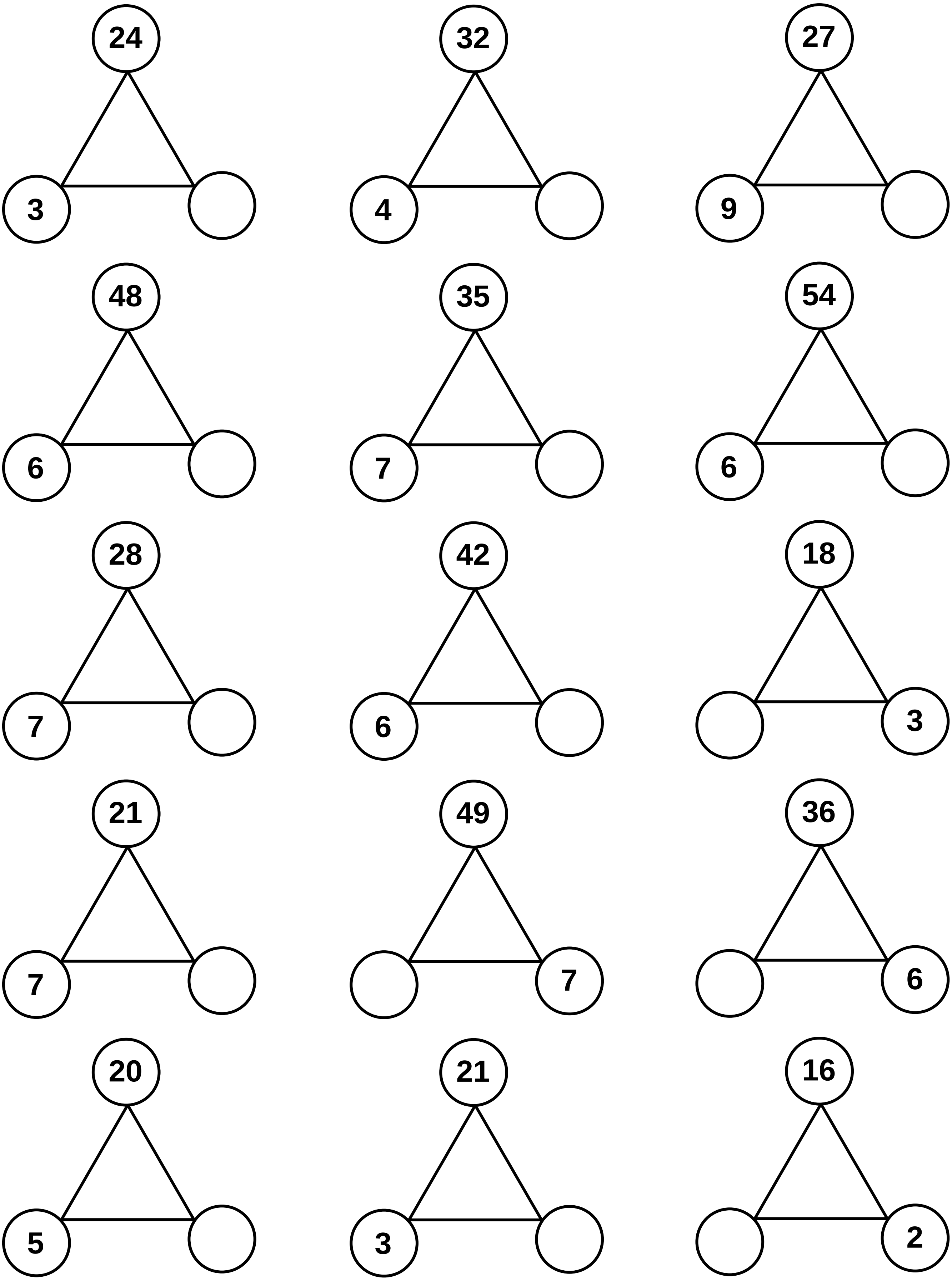
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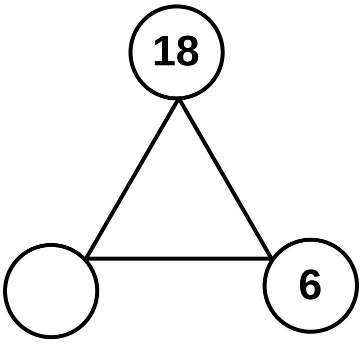
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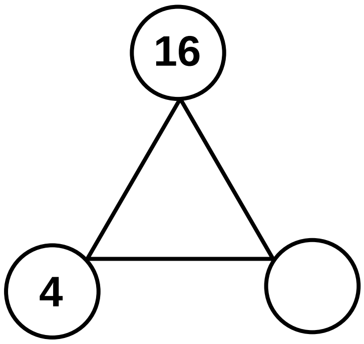
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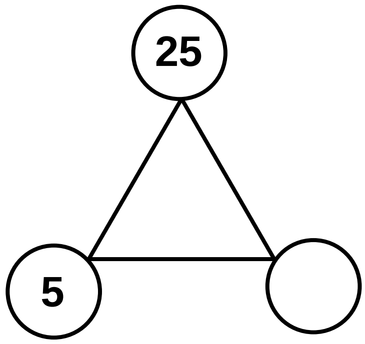
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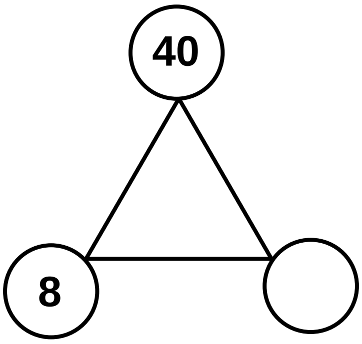
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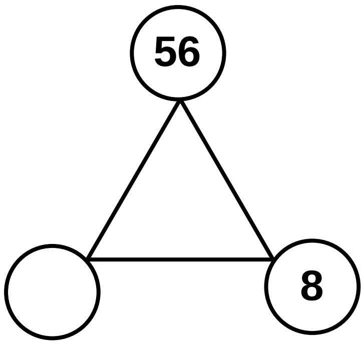
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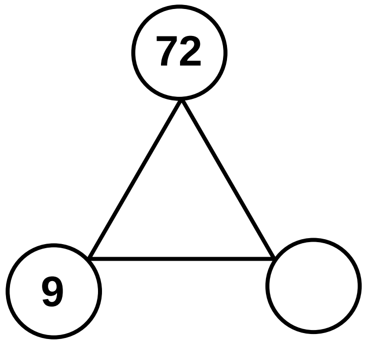
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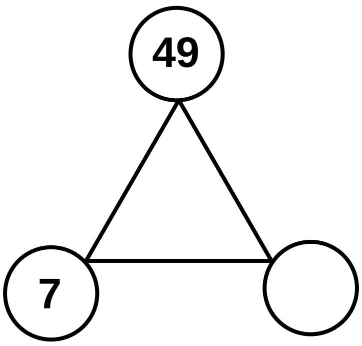
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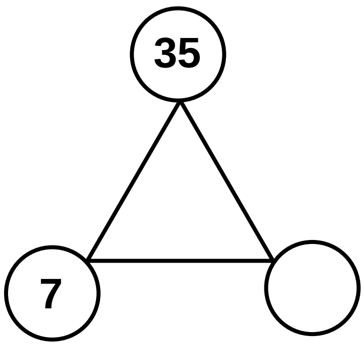
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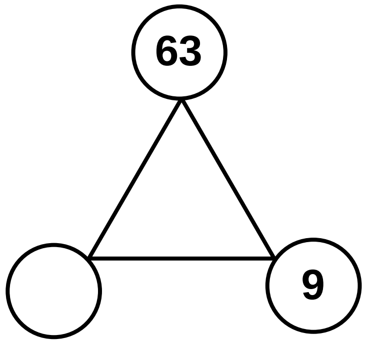
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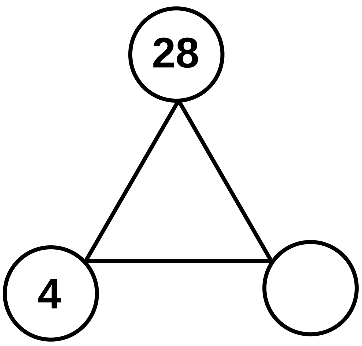
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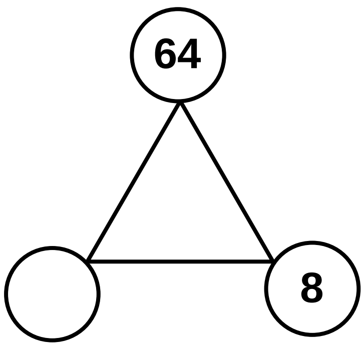
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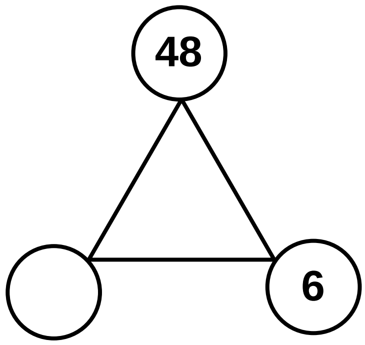
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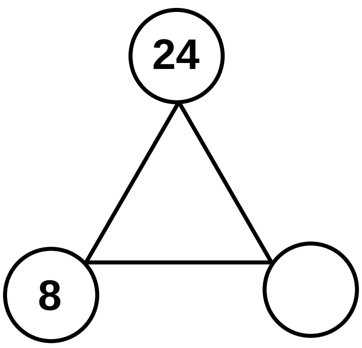
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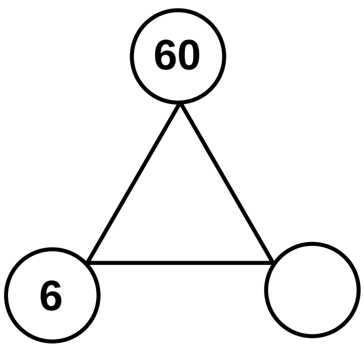
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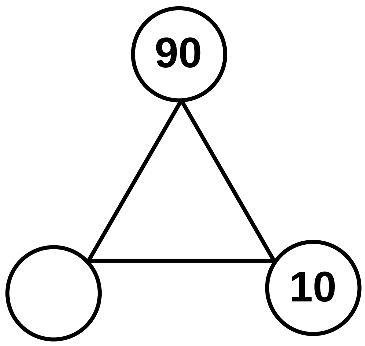
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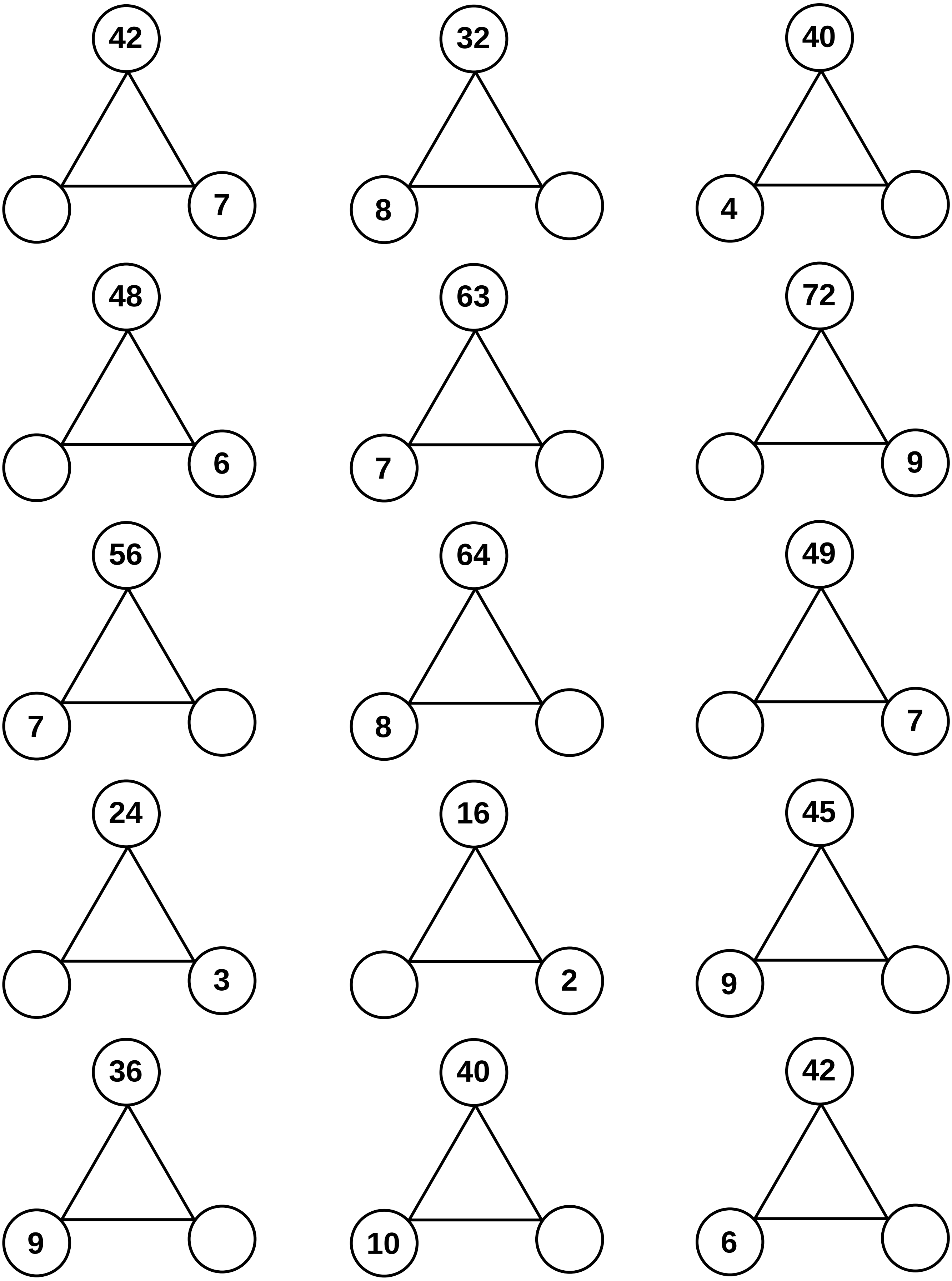
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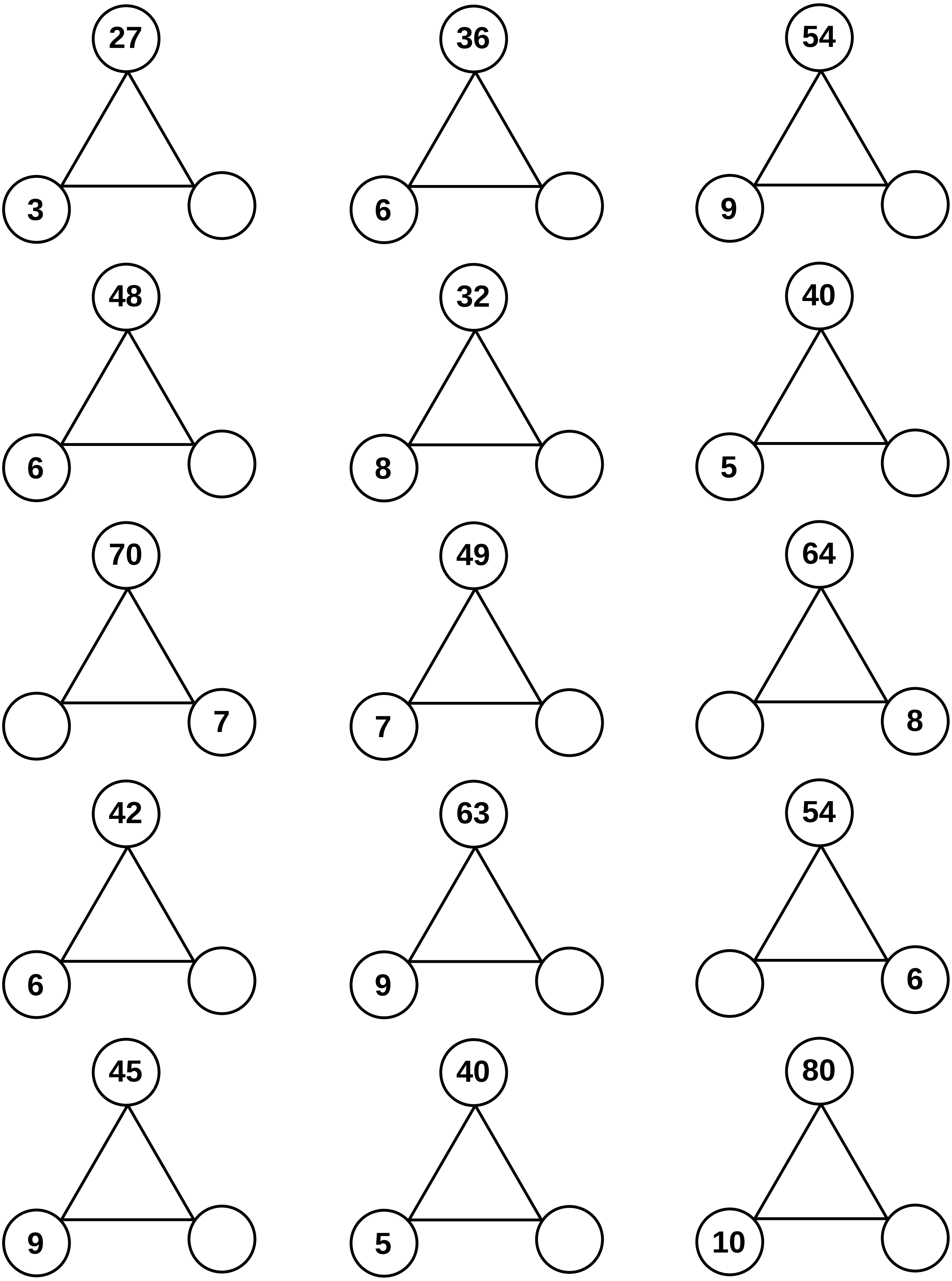
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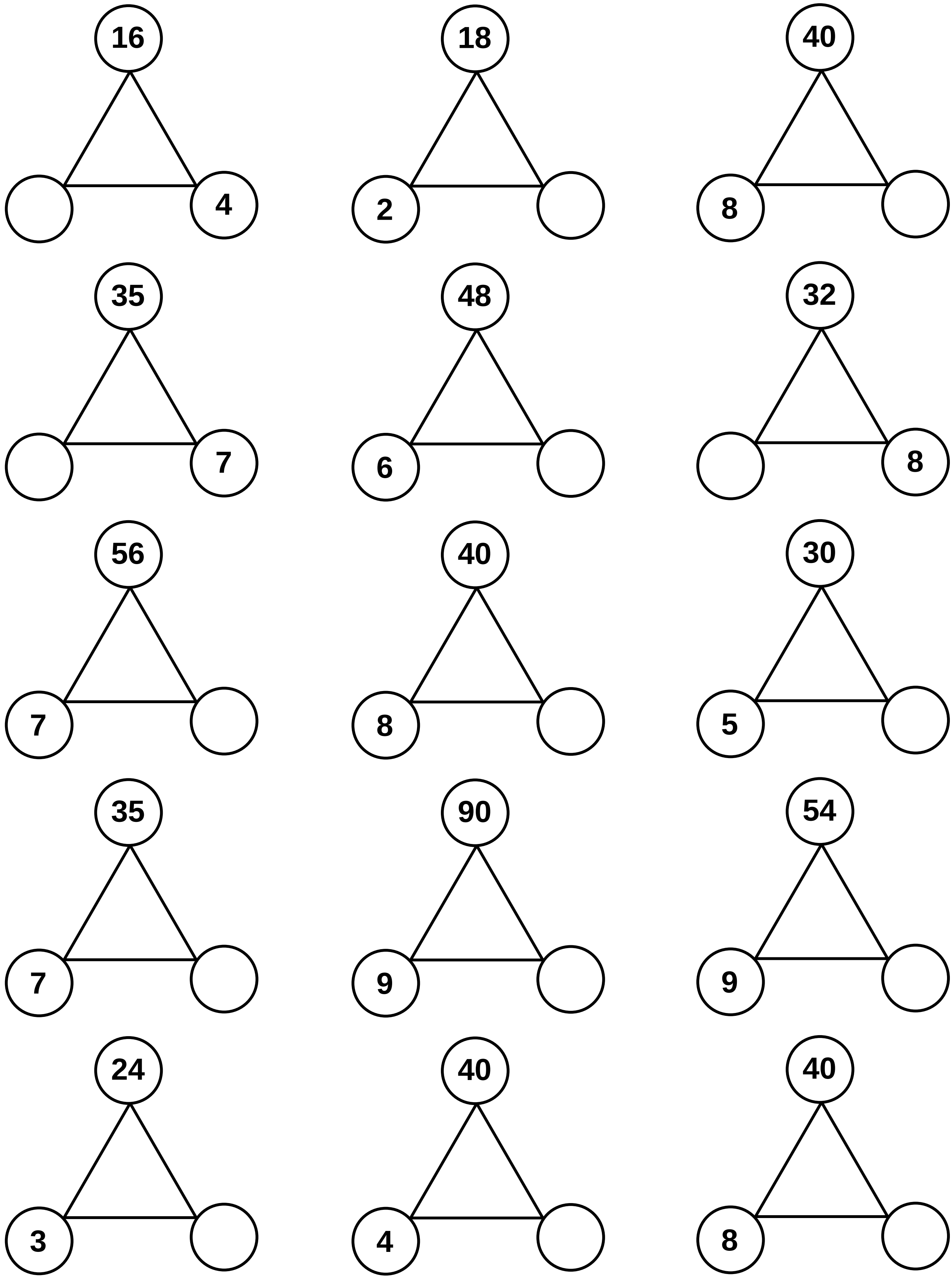
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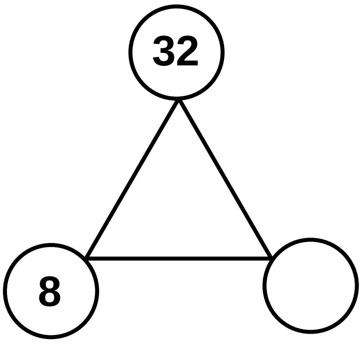
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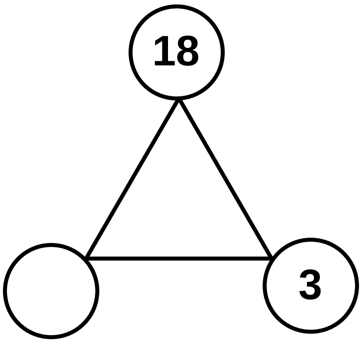
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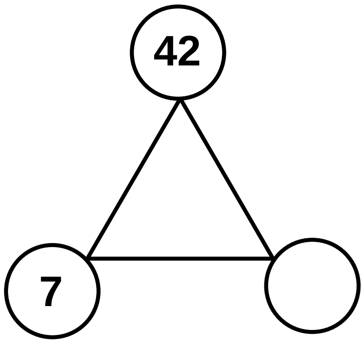
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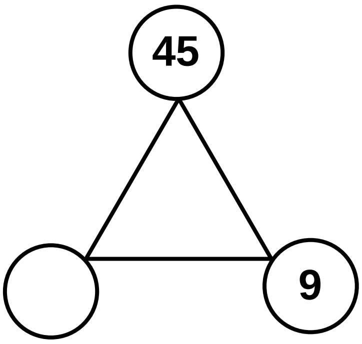
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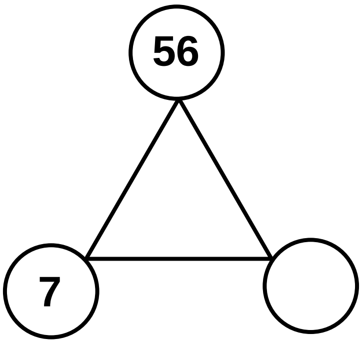
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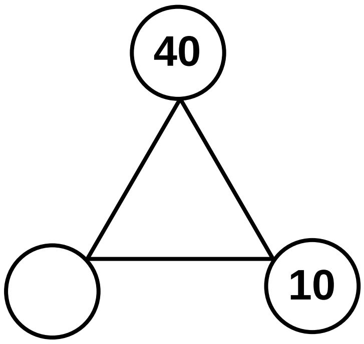
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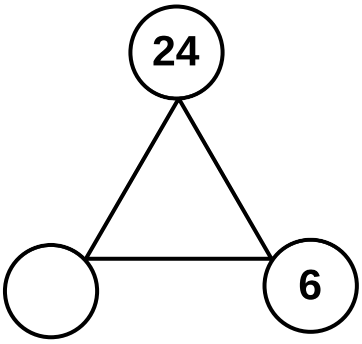
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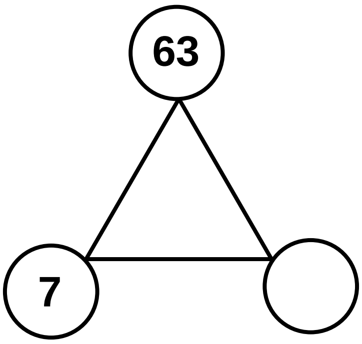
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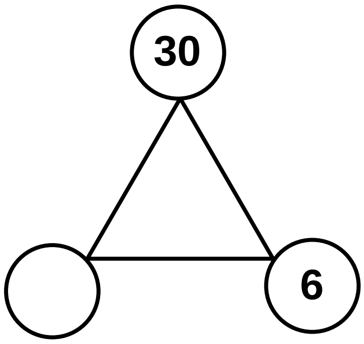
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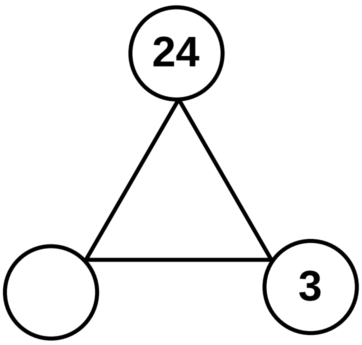
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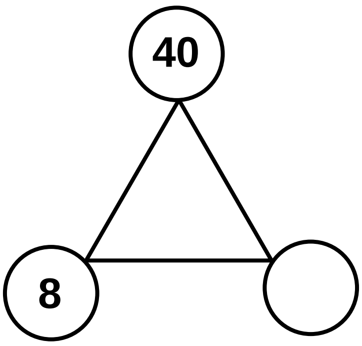
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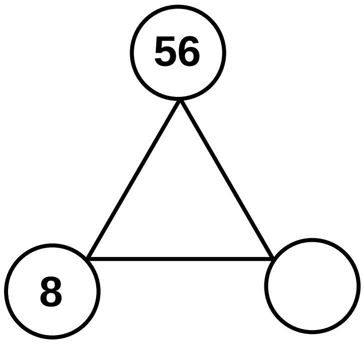
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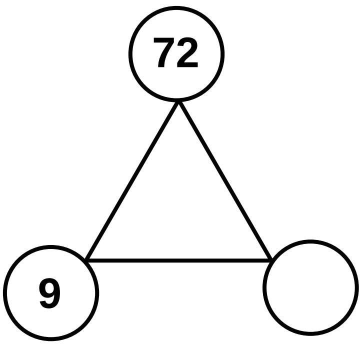
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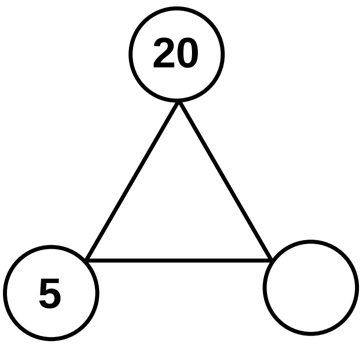
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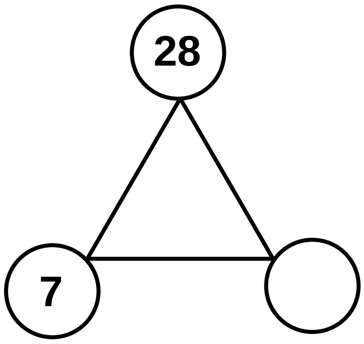
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Activities Using Multiplication Facts

On the next pages you will find a number of activities you can try to practise your multiplication tables skills. I must warn you that some of them are quite easy and some towards the end are very difficult, so you should choose the ones that you think you will be able to tackle without tying your brain up in knots.

Activity 1: Missing Numbers in Times Tables

TEST 1

1. 2 x ___ = 6	**2.** 7 x ___ = 21	**3.** 9 x ___ = 45
4. ___ x 6 = 36	**5.** 8 x ___ = 56	**6.** ___ x 4 = 28
7. ___ x 5 = 50	**8.** 9 x ___ = 81	**9.** 10 x ___ = 60
10. 9 x ___ = 36	**11.** 8 x ___ = 32	**12.** ___ x ___ = 21
13. 7 x ___ = 49	**14.** 4 x ___ = 4	**15.** ___ x 8 = 32
16. 9 x ___ = 63	**17.** 8 x ___ = 24	**18.** ___ x 2 = 20

TEST 2

1. 7 x ___ = 42	**2.** 3 x ___ = 27	**3.** 8 x ___ = 40
4. ___ x 7 = 28	**5.** 9 x ___ = 72	**6.** ___ x 5 = 35
7. ___ x 8 = 32	**8.** 10 x ___ = 90	**9.** 7 x ___ = 63
10. 4 x ___ = 28	**11.** 7 x ___ = 42	**12.** 9 x ___ = 72
13. 6 x ___ = 54	**14.** 7 x ___ = 56	**15.** ___ x 6 = 24
16. 8 x ___ = 64	**17.** 9 x ___ = 63	**18.** ___ x 6 = 54

TEST 3

1. 4 x ___ = 24	**2.** 8 x ___ = 32	**3.** 7 x ___ = 49
4. ___ x 8 = 48	**5.** 7 x ___ = 63	**6.** ___ x 5 = 45
7. ___ x 8 = 64	**8.** 8 x ___ = 16	**9.** 4 x ___ = 28
10. 7 x ___ = 28	**11.** 6 x ___ = 36	**12.** 7 x ___ = 21
13. 9 x ___ = 81	**14.** 5 x ___ = 45	**15.** ___ x 7 = 49
16. 8 x ___ = 40	**17.** 9 x ___ = 54	**18.** ___ x 3 = 27

TEST 4

1. 7 x ___ = 42	**2.** 8 x ___ = 24	**3.** 2 x ___ = 20
4. ___ x 5 = 35	**5.** 9 x ___ = 45	**6.** ___ x 3 = 27
7. ___ x 7 = 49	**8.** 3 x ___ = 24	**9.** 6 x ___ = 36
10. 8 x ___ = 40	**11.** 7 x ___ = 14	**12.** 8 x ___ = 8
13. 6 x ___ = 48	**14.** 5 x ___ = 25	**15.** ___ x 9 = 36
16. 6 x ___ = 54	**17.** 7 x ___ = 28	**18.** ___ x 3 = 30

TEST 5

1. 3 x ___ = 9 **2.** 6 x ___ = 24 **3.** 8 x ___ = 48

4. ___ x 5 = 25 **5.** 1 x ___ = 9 **6.** ___ x 5 = 35

7. ___ x 6 = 60 **8.** 8 x ___ = 72 **9.** 4 x ___ = 36

10. 8 x ___ = 40 **11.** 6 x ___ = 30 **12.** ___ x 3 = 21

13. 8 x ___ = 32 **14.** 5 x ___ = 45 **15.** ___ x 6 = 54

16. 7 x ___ = 63 **17.** 5 x ___ = 35 **18.** ___ x 9 = 90

TEST 6

1. 4 x ___ = 36 **2.** 8 x ___ = 24 **3.** 7 x ___ = 63

4. ___ x 7 = 49 **5.** 6 x ___ = 36 **6.** ___ x 5 = 35

7. ___ x 9 = 45 **8.** 8 x ___ = 80 **9.** 10 x ___ = 100

10. 6 x ___ = 54 **11.** 2 x ___ = 14 **12.** 5 x ___ = 25

13. 8 x ___ = 64 **14.** 3 x ___ = 9 **15.** ___ x 5 = 35

16. 4 x ___ = 32 **17.** 5 x ___ = 25 **18.** ___ x 7 = 14

Activity 2: Multiplication Sums

First of all you can warm up by just <u>multiplying by one digit</u>:

1. 27 × 4	**2.** 17 × 6	**3.** 39 × 3	**4.** 15 × 9	**5.** 45 × 8
6. 44 × 2	**7.** 63 × 5	**8.** 71 × 8	**9.** 97 × 7	**10.** 30 × 3
11. 43 × 6	**12.** 48 × 4	**13.** 96 × 1	**14.** 17 × 7	**15.** 52 × 9
16. 98 × 2	**17.** 54 × 5	**18.** 19 × 7	**19.** 91 × 4	**20.** 69 × 6
21. 51 × 8	**22.** 38 × 8	**23.** 28 × 2	**24.** 20 × 3	**25.** 15 × 5

Now try <u>multiplying by two digit numbers</u>. Don't forget to put the zero in where necessary.

26. $\begin{array}{r} 45 \\ \underline{\times\ 63} \end{array}$ **27.** $\begin{array}{r} 23 \\ \underline{\times\ 54} \end{array}$ **28.** $\begin{array}{r} 48 \\ \underline{\times\ 84} \end{array}$ **29.** $\begin{array}{r} 37 \\ \underline{\times\ 27} \end{array}$ **30.** $\begin{array}{r} 26 \\ \underline{\times\ 48} \end{array}$

31. $\begin{array}{r} 82 \\ \underline{\times\ 63} \end{array}$ **32.** $\begin{array}{r} 43 \\ \underline{\times\ 32} \end{array}$ **33.** $\begin{array}{r} 23 \\ \underline{\times\ 23} \end{array}$ **34.** $\begin{array}{r} 63 \\ \underline{\times\ 75} \end{array}$ **35.** $\begin{array}{r} 82 \\ \underline{\times\ 33} \end{array}$

36. $\begin{array}{r} 36 \\ \underline{\times\ 13} \end{array}$ **37.** $\begin{array}{r} 35 \\ \underline{\times\ 37} \end{array}$ **38.** $\begin{array}{r} 74 \\ \underline{\times\ 43} \end{array}$ **39.** $\begin{array}{r} 24 \\ \underline{\times\ 37} \end{array}$ **40.** $\begin{array}{r} 53 \\ \underline{\times\ 82} \end{array}$

41. $\begin{array}{r} 37 \\ \underline{\times\ 53} \end{array}$ **42.** $\begin{array}{r} 73 \\ \underline{\times\ 22} \end{array}$ **43.** $\begin{array}{r} 25 \\ \underline{\times\ 53} \end{array}$ **44.** $\begin{array}{r} 52 \\ \underline{\times\ 66} \end{array}$ **45.** $\begin{array}{r} 73 \\ \underline{\times\ 73} \end{array}$

46. $\begin{array}{r} 63 \\ \times\ 35 \\ \hline \end{array}$ **47.** $\begin{array}{r} 44 \\ \times\ 57 \\ \hline \end{array}$ **48.** $\begin{array}{r} 63 \\ \times\ 38 \\ \hline \end{array}$ **49.** $\begin{array}{r} 28 \\ \times\ 40 \\ \hline \end{array}$ **50.** $\begin{array}{r} 43 \\ \times\ 45 \\ \hline \end{array}$

51. $\begin{array}{r} 214 \\ \times\ 17 \\ \hline \end{array}$ 5**2**. $\begin{array}{r} 362 \\ \times\ 61 \\ \hline \end{array}$ 5**3**. $\begin{array}{r} 439 \\ \times\ 20 \\ \hline \end{array}$ **54**. $\begin{array}{r} 114 \\ \times\ 43 \\ \hline \end{array}$ **55**. $\begin{array}{r} 561 \\ \times\ 23 \\ \hline \end{array}$

56. $\begin{array}{r} 253 \\ \times\ 22 \\ \hline \end{array}$ **57**. $\begin{array}{r} 788 \\ \times\ 34 \\ \hline \end{array}$ **58**. $\begin{array}{r} 630 \\ \times\ 65 \\ \hline \end{array}$ **59**. $\begin{array}{r} 110 \\ \times\ 48 \\ \hline \end{array}$ **60**. $\begin{array}{r} 532 \\ \times\ 25 \\ \hline \end{array}$

61 $\begin{array}{r} 739 \\ \times\ 52 \\ \hline \end{array}$ **62**. $\begin{array}{r} 479 \\ \times\ 53 \\ \hline \end{array}$ **63**. $\begin{array}{r} 241 \\ \times\ 66 \\ \hline \end{array}$ **64**. $\begin{array}{r} 250 \\ \times\ 83 \\ \hline \end{array}$ **65**. $\begin{array}{r} 543 \\ \times\ 25 \\ \hline \end{array}$

66 183
× 49

67. 346
× 14

68. 624
× 50

69. 357
× 51

70. 982
× 84

71. 453
× 34

72. 515
× 44

73. 874
× 36

74. 230
× 57

75. 632
× 77

76. 2373
× 11

77. 7418
× 16

78. 1913
× 14

79. 2574
× 30

80. 9421
× 24

81. 6179
× 35

82. 8725
× 73

83. 3339
× 41

Sometimes we need to multiply quite long numbers by one or two digits, so here is some practice in these skills. You will need to be able to do this if you want to tackle the cross-figures later.

84. $\begin{array}{r} 253216 \\ \times\ 7 \\ \hline \end{array}$

85. $\begin{array}{r} 846364 \\ \times\ 9 \\ \hline \end{array}$

86. $\begin{array}{r} 4275937354 \\ \times\ 6 \\ \hline \end{array}$

87. $\begin{array}{r} 327531 \\ \times\ 5 \\ \hline \end{array}$

88. $\begin{array}{r} 521744 \\ x\ 4 \\ \hline \end{array}$

89. $\begin{array}{r} 93625412 \\ \times\ 8 \\ \hline \end{array}$

90. $\begin{array}{r} 327631 \\ \times\ 23 \\ \hline \end{array}$

91. $\begin{array}{r} 812538 \\ \times\ 58 \\ \hline \end{array}$

92. $\begin{array}{r} 66228844 \\ \times\ 46 \\ \hline \end{array}$

Ready for your hot chocolate and biscuits? I bet you are!

Activity 3: Money Sums

You must be very good with your multiplication tables by now, but that is really just the beginning. You will spend a lot of the rest of your life using them in all sorts of situations and money calculations is just one of those.

So, here is your chance to apply what you have learnt to money problems and then you can amaze your teacher . Be careful to read the questions carefully.

Before we begin, remember that you can write quantities of money with a decimal point (in £'s) or without a decimal point (in pence). For example, £6.45 can also be written as 645p.

Quite often we need to work in pence, but at the end of the sum you may want to change your answer to pounds.

Here is an example:

John bought four cakes costing 67p each. How much did they cost altogether?

We work out 67 x 4 which is 268. This is 268p, of course. Normally we would change this to £2.68, so try to do that if your answers come to more than a pound.

Okay, here we go! And no Calculators remember!

1. Bruiser comics cost 65p. 32 pupils want to buy one each.
What is the total cost of the comics?

2. Georgina has sixty seven 10p coins.
How much are they worth altogether?

3. A teacher buys 36 geography text books for her class.
Each book costs £6. How much does she have to pay for the set of books?

4. A can of Doke costs 76p. How much will 12 cans of Doke cost?

5. A pencil costs 12p and a ruler costs 32p.
How much will 16 pencils and 15 rulers cost altogether?

6. Notepads normally cost 45p each. Jane bought 12 of these.

Next day Mohammad saw the same notepads in another shop for just 40p each, so he bought 12 too.

How much more did Jane pay for her notepads than Mohammad?

7. A teacher took her class of thirty pupils to visit a museum.
The entrance fee for children was 95p and free for the teacher.

What was the total cost of the visit?

8. Mary saves 65p a week from her pocket money.
How much would she have saved after 16 weeks?

9. Tom ate twenty four cherry cakes, costing 36p each.
How much did the cakes cost his mum?

10. In a sale, DVDs were being sold for 99p each. Ken bought 23 DVDs.
How much did he have to pay?

11. Ribbon costs 78p a metre. How much would 35 metres cost?

12. Teddy stickers cost 12p each. An infant school wants to buy 450 for all its pupils. How much would they cost?

13. Mary bought nine cups, nine saucers and twelve teaspoons.

Cups cost 89p each
Saucers cost 99p each
Teaspoons cost 56p each.

How much did Mary have to pay altogether?

14. Lemonade costs 45p per litre. How much would 56 litres cost?

15. Fred had 78p in his pocket. Jenny had three times as much.
How much did Jenny have?

16. Mrs Jones was organising a party for nine children.

She bought:
nine packets of crisps at 35p each,
nine canned drinks at 67p each and
nine rolls at 99p each.

What was the total cost?

17. How many pence are there in:

a) £3.45 b) £6.98 c) £0.87 d) £12.65 e) £9.99 f) £10 ?

18. Which is cheaper:

4 kilometres in a taxi at 89p per kilometre or

12 kilometres on a bus at 31p per kilometre?

19. Jojo has five 20p coins, seventeen 5p coins and six 50p coins.
Does she have enough to buy a CD costing £4.30? Explain your answer.

20. A felt pen costs 89p. How much would 48 pens cost?

(Note to parents: So far we have not introduced the decimal point into the problems, except when converting pence in an answer to pounds. If your son or daughter has not yet covered multiplying decimals please stop here and move on to the next activity. If they have covered multiplying decimals, allow them to carry on with the following questions.)

21. Harry bought 6 CDs costing £3.78 each. What was the total cost?

22. Jeremy earned £4.50 a week washing cars.
How much did he earn in 9 weeks?

23. Ghodsi bought ten puppets costing £3.20 each.
How much did she have to pay?

24. Light bulbs cost £1.25 each. Mr Jones owns a small hotel and needs 45 light bulbs. How much will this cost him?

25. Kelly was given two puppies for her birthday and needed two leads. The leads cost £4.89 each. How much did she have to pay for both leads?

26. Jeremy bought 50 stamps costing £1.34 each. What was the total cost?

27. What is 26 times £12.50 ?

28. Which is greater, three lots of £23.67 or four lots of £18.55? Explain your answer.

29. A British pound costs 1.23 Euros. How much did Pierre have to pay in Euros for £70 ?

30. A man bought three jackets costing £34.80 each. What was the total cost?

31. What is the total cost of a CD player costing £45.67, three CDs costing £8.99 each and four pairs of earmuffs costing £0.99 each?

32. A fairground ride cost £1.50. How much did Jean have to pay for herself, her three brothers, her two sisters, her two aunts and three uncles to have a ride?

33. A farmer buys twelve tonnes of manure costing £34.50 per tonne and six clothes pegs costing 45p each. What was the total cost?

34. A Buzzy Frisbee costs £2.23. What would 45 freebies cost?

35. What is the total cost of seven jumpers costing £6.80 and four tee shirts costing £3.99 each?

36. In a sale a coat that was being sold at half price cost £45.60. Mrs Henry missed the sale and had to pay the full price. How much was that?

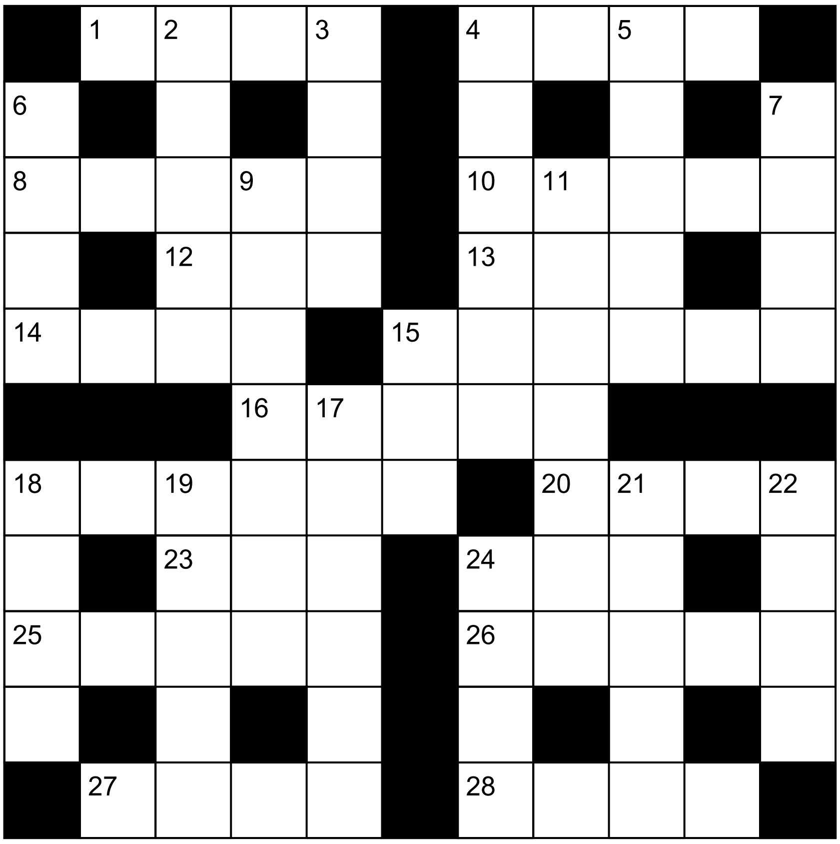
37. What is the cost of 25 cartoon books if each book cost £3.89 ?

38. A television costs £345.80. How much would ten of these televisions cost?

Activity 4: Cross Figures

Why not practise your times tables and have fun at the same time? What better way than to tackle a couple of Cross Figures, which are just like crosswords, but with numbers instead of words and all the clues are sums – in this case multiplication sums.

Just one thing before you begin: **Don't forget that 56^2 means '56 squared' which is 56 x 56.** So now you can do clues like 14 across and 24 down.



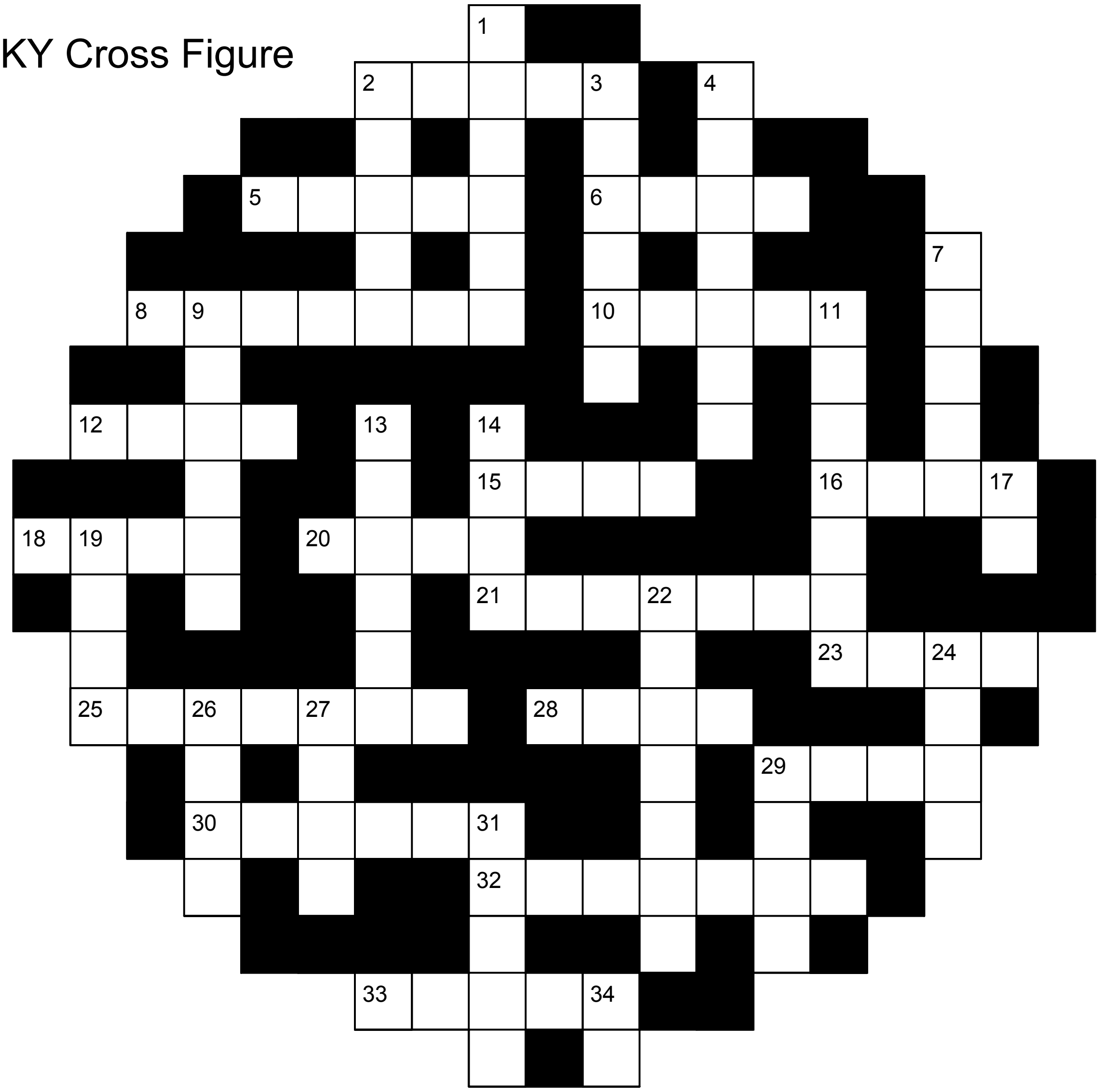
Across Clues

1. 803 x 7
4. 101 x 10
8. 1034 x 51
10. 2714 x 23
12. 15 x 14
13. 17 x 25
14. 36^2
15. 656 x 222
16. 1442 x 39
18. 321^2
20. 65^2
23. 149 x 2
24. 26 x 37
25. 10010 x 5
26. 855 x 54
27. 321 x 27
28. 300 x 30

Down Clues

2. 29 x 2301
3. 120 x 12
4. 15111 x 13
5. 116^2
6. 39^2
7. 2424 x 3
9. 633019 x 5
11. 322638 x 7
15. 11^2
17. 24001 x 27
18. 21 x 93
19. 486 x 66
21. 632 x 35
22. 72 x 82
24. 97^2

FUNKY Cross Figure



Across Clues

2. 2431 x 27
5. 315^2
6. 434 x 12
8. 323212 x 9
10. 2853 x 24
12. 431x 9
15. 101 x 20
16. 302 x 24
18. 21 x 65
20. 219 x 11
21. 2222037 x 3
23. 5 x 5 x 5 x 5 x 5 x 2
25. 2047^2
28. 48^2
29. 301 x 21
30. 777 x 222
32. 120405 x 12
33. 2853 x 12

Down Clues

1. 54467 x 14
2. 2181 x 29
3. 891 x 848
4. 286476 x 22
7. 122^2
9. 164609 x 6
11. 1596^2
13. 120700 x 6
14. 36^2
17. 9^2
19. 58^2
22. 100021 x 64
24. 1122 x 5
26. 31 x 31 x 10
27. 101 x 4 x 7
29. 58 x 120
31. 5975 x 7
34. 8^2

Activity 5: Times Tables and Factors (1)

Great fun, factors, and they are extremely useful when doing all sorts of things in mathematics. For example, they are most helpful when doing calculations with fractions as you shall see very soon.

They are also an important part of the study of prime numbers, so a good knowledge of factors will help you with this topic too.

Factors, of course, are closely related to multiplication table facts and if you know your multiplication tables well, that is a great start.

Believe me, not many people bother to learn their tables well enough, so you must be making great progress and good progress means you will feel more confident. More confidence means more progress and so it goes on.

Well, that's enough of the waffle, let's get on with the work….

Now, you probably know that a factor is a number that will divide exactly into another number. For example, **3** divides into **21** exactly **7** times, so **3** is a factor of **21**.

5 divides exactly into **45**, so **5** is a factor of **45**.

So far, so good, but there are a couple of other things you should know about factors:

<u>First</u> of all, the number **1** is a factor of any number, because **1** divides exactly into all numbers.

<u>Secondly</u>, sometimes we want to include the number itself and sometimes we don't. For example, the factors of **12** are **1, 2, 3, 4, 6** and **12**. Sometimes we want to include the number **12** and sometimes we don't – it depends what we are doing.

If we do not want to include the number itself and it is not obvious, we call the other factors the 'proper factors'.

So, **1, 2, 3, 4, 6** and **12** are the factors of **12**, but **1, 2, 3, 4, 6** are the 'proper factors' of **12**. I know this sounds a little complicated, but it's not really ever a problem – just be aware that sometimes we want to include the number itself and sometimes we don't.

When you are asked to find the factors of a number, it is normally a good idea to include the number itself, so try to remember to do that.

<u>Thirdly</u>, you need to know how to find the factors of a number and I am now going to show you a short cut that will help you, especially with large numbers.

Did you notice that when I said **3** divides exactly into **21**, it went **7** times. This means that **7** must be a factor too.

We can use this to help us find the factors of large numbers.

Let's say we want to find the factors of **120**.

First we know that **1** goes into **120** and it goes **120** times, of course, so **120** must be a factor too.

Next we try dividing **120** by **2** and the answer is **60**, so sixty must also be a factor because it divides into **120** twice.

When we divide **120** by **3**, we get **40**, so **40** must be a factor.

Can you see how quickly we are finding the factors by using this simple fact?

To help us remember the factors, we can write them down like this:

1, **120**

Notice the big space to fill in the other factors.

Next we add the **2** and the **60**:

1, 2, **60, 120**

Now the **3** and **40**:

1, 2, 3, **40, 60, 120**

You will soon see that **4** divides into **120** exactly **30** times, so that's two more factors we can add:

1, 2, 3, 4, 30, 40, 60, 120

As it happens, **5** goes into **120** and the answer is **24**, so **5** and **24** are factors too:

1, 2, 3, 4, 5, 24, 30, 40, 60, 120

6 goes into **120** exactly **20** times, so we can add those:

1, 2, 3, 4, 5, 6, 20, 24, 30, 40, 60, 120

Next we try to divide by **7**, but **7** will not divide into **120** exactly, so we try **8** and that goes **15** times, so add these to our list:

1, 2, 3, 4, 5, 6, 8, 15, 20, 24, 30, 40, 60, 120

9 will not divide into **120**, so we try **10** and that goes **12** times, of course, so we can add these:

1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 24, 30, 40, 60, 120

You will have noticed as we worked out the factors that the numbers on the right of the list were getting smaller and the numbers on the left were getting bigger, so they have to meet in the middle.

The only number left between **10** and **12** is **11** and that will not divide exactly into **120** so we have finished.

1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 24, 30, 40, 60, 120 are all the factors of **120**.

This takes much longer to explain than to do and I will give you another example in a moment, but before I do that, there is one thing that may be worrying you – We have tried dividing by all the smaller numbers, but could there be another factor in the higher numbers that we have missed?

Could there be another factor between **40** and **60**, for example?

The answer is a definite NO. **60** divides into **120** exactly **2** times and **40** divides exactly **3** times. If there were another factor between **40** and **60**, it would divide two and a bit times. In other words, it would not divide exactly.

We can safely say we have found all the factors.

I hope you can see that this method is much faster than trying to divide by all the numbers up to **120** (or even just **60**).

Let's try another one together, to make sure you have understood properly.

Suppose we want to find the factors of 210.

First we divide **210** by **1** and get:

1, 210

Then divide by **2**:

1, 2, 105, 210

Then by **3**:

1, 2, 3, 70, 105, 210

4 will not divide exactly, so the next number is **5** which goes **42** times:

1, 2, 3, 5, 42, 70, 105, 210

Then **6** which goes **35** times:

1, 2, 3, 5, 6, 35, 42, 70, 105, 210

Notice how the numbers on the right are getting smaller and the numbers on the left are getting bigger, so it's not long before they are going to meet.

Next we try dividing by **7**, which divides exactly **30** times:

1, 2, 3, 5, 6, 7, 30, 35, 42, 70, 105, 210

8 will not divide (we know this because **4** would not)

9 will not divide

10 divides exactly **21** times:

1, 2, 3, 5, 6, 7, 10, 21, 30, 35, 42, 70, 105, 210

11, **12**, and **13** will not divide exactly

14 divides **15** times:

1, 2, 3, 5, 6, 7, 10, 14, 15, 21, 30, 35, 42, 70, 105, 210

As **14** and **15** are next to each other, we have finished and we have found all the factors of **210**.

That wasn't too bad, was it?

Now it's your turn. Try finding the factors of these numbers:

60, 100, 84, 96, 220, 250, 72, 75, 128

I hope you found all the factors. There's lots more in the other two tasks dealing with factors. See you then.

Activity 6: Times Tables and Fractions (1)

In this task I am going to teach you the most important ideas about fractions. Of course, you may have covered these at school, but if not, I hope you will appreciate how much easier fractions can become and how quickly you can do them with a good knowledge of multiplication tables.

The most important idea in fractions is **Equivalent Fractions**. Many people think that equivalent fractions are just one of the topics in fraction work that have to be covered, but they pop up every time we do a calculation using fractions, so it is very important to really understand what they are all about.

Let's begin with a definition:

<u>Equivalent fractions</u> are fractions that look different, but are actually the same value.

Take the fraction $\frac{1}{2}$, for example. I am sure you know it is the same as $\frac{2}{4}$.

It just looks different.

The numerator (the number in the top line) and the denominator (the number in the bottom line) have changed, but the two fractions are the same.

If you had $\frac{1}{2}$ a cake and I had $\frac{2}{4}$, we would both have the same amount of cake.

Sometimes we wish to make the numerator and the denominator in a fraction smaller to simplify the fraction and sometimes we want to increase them, when adding, for instance.

When the numerator and the denominator are made smaller, we call the process '**cancelling'**.

To **cancel** a fraction, we look for a number that is a factor of **both** the numerator and denominator.

Take the fraction $\frac{20}{24}$, for instance. Can we find a number that is both a factor of **20**

and a factor of **24**? You may have said '**2**' or you may have said '**4**'. Normally we like to go for the largest number we can find – it saves work in the long run.

Using the '**4**', we divide **4** into **20** and **4** into **24** to get the fraction $\frac{5}{6}$.

We say that we have '**cancelled'** by **4**. If we had cancelled by **2** instead, we would

have the answer $\frac{10}{12}$, which we could then cancel by two again to get $\frac{5}{6}$ as before.

The fractions $\frac{20}{24}$, $\frac{10}{12}$ and $\frac{5}{6}$ are equivalent fractions. They look different, but

actually have the same value.

When the numerator and the denominator are as small as possible as in $\frac{5}{6}$, we say the fraction is in its '**lowest terms**'.

You can see how important it is to know your multiplication tables for this work. If you know them well, you will quickly see that both **20** and **24** are in the **4** times table, so **4** must be a factor of **20** and **24** and we can use this to **cancel** the fraction. This would be very difficult to do if you did not know the tables, especially as the numbers get bigger.

Let's try a more difficult fraction.

We will cancel the fraction $\frac{225}{360}$.

There are different ways you can approach this fraction, but it is unlikely you will be able to cancel in one go, so let's start with a small number.

We can see that **225** ends with a **5** and **360** ends with a **0**, so **5** must be a factor of **225** and **360** and we can start by cancelling by that. **5** divides into **225** exactly **45** times and **5** divides into **360** exactly **72** times, so that gives

us $\frac{45}{72}$.

Now, here is where a good knowledge of multiplication tables is useful. If you know them really well, you will see that both **45** and **72** are in the **9** times table, which means we can cancel both numbers by **9**.

This gives us $\frac{5}{8}$ and a moment's thought will convince you that this fraction will not cancel any more.

So the fractions $\frac{225}{360}$, $\frac{45}{72}$ and $\frac{5}{8}$ are all equivalent fractions and the last one is in

its lowest terms.

We will see in a moment how useful all this can be, but first…..

Sometimes we want to make the numerator and the denominator bigger and for this we use the word '**lecnacing'**. You will notice that the word '**lecnac'** is the word '**cancel'** spelt backwards. That is to emphasise that they are opposite processes.

To **lecnac** a fraction, we multiply both the numerator and the denominator by the same number.

Let us take the fraction $\frac{5}{8}$ as an example.

We can multiply the numerator and the denominator by **2** to get $\frac{10}{16}$.

Or we could have multiplied them by **3** to get $\frac{15}{24}$.

Or by **4** to get $\frac{20}{32}$.

We can keep doing this to get a whole chain of fractions that are all equivalent to each other, like this:

$\frac{5}{8} \quad \frac{10}{16} \quad \frac{15}{24} \quad \frac{20}{32} \quad \frac{25}{40} \quad \frac{30}{48} \quad \frac{35}{56}$ ………

It is important to remember that all these fractions have the same value, so if we do something to one of them (like add another fraction to it) it is the same as doing that to any of the other equivalent fractions.

Try continuing these chains of fractions:

$\frac{1}{2}$ $\frac{2}{4}$ $\frac{3}{6}$

$\frac{2}{3}$ $\frac{4}{6}$ $\frac{6}{9}$

$\frac{3}{5}$ $\frac{6}{10}$ $\frac{9}{15}$

So, now let's see why equivalent fractions are so useful.

Suppose we want to add two fractions, say $\frac{3}{7} + \frac{2}{9}$.

We cannot add them as they are because **7ths** are not the same size pieces as **9ths**.

What we need to do is to make the pieces the same size by **lecnacing** until the denominators are the same.

The first question is therefore, 'What number will **7** and **9** both divide into?'

There are many numbers they will both divide into, but we normally go for the smallest one we can find, which is **63**. We want to write both fractions with a denominator of **63**. Let's do them one at a time.

To get $\frac{3}{7}$ into $\frac{}{63}$, we can see we need to lecnac by **9**, because the denominator

has already been multiplied by **9**.
So we must multiply the **3** by **9** too. This gives us $\frac{27}{63}$.

To get $\frac{2}{9}$ into $\frac{}{63}$, we need to lecnac by **7**. This gives us $\frac{14}{63}$.

The sum $\frac{3}{7} + \frac{2}{9}$ has now become $\frac{27}{63} + \frac{14}{63}$

Because the denominators are both **63**, we can add the numerators to get $\frac{41}{63}$
,

which is the answer to the original sum.

To be able to do this, you need a good knowledge of:

multiplication tables
equivalent fractions
lecnacing and
numerator and denominator of fractions.

Let's try another question and this time we will write it out as you would at school.

Find $\frac{4}{5} + \frac{7}{8}$

Here is the working: $\frac{4}{5} + \frac{7}{8} = \frac{32}{40} + \frac{35}{40} = \frac{67}{40}$

Can you see what we have done? First we found a number that **5** and **8** will divide into and, because we know our tables really well, it was easy to see that the number is **40**.

We made **40** the new denominator of both fractions.

Looking at the first fraction, we see we have to lecnac by **8**, which we did.

Looking at the second fraction, we see we have to lecnac by **5**, which we also did.

Then we added them together. Easy, yes?!

With this answer, there is just one extra step to take. You may have noticed that the answer is a top heavy fraction (or 'improper' fraction as we sometimes say). This is because **67** is greater than **40**.

We only need $\frac{40}{40}$ to make a whole one (equivalent fractions again!) so we can

make a whole one and still have $\frac{27}{40}$ left. The full answer is therefore $1\frac{27}{40}$

Now, why don't you try a few using this method of lecnacing?
(What do you mean, your brain's full!?)

1. $\frac{1}{9} + \frac{1}{5}$

2. $\frac{3}{5} + \frac{1}{7}$

3. $\frac{1}{2} + \frac{1}{6}$

4. $\frac{3}{4} + \frac{1}{3}$

5. $\frac{3}{7} + \frac{3}{8}$

Activity 7: Digital Roots

Digital roots are just a bit of fun really. I don't know of any practical use for them except to practise your multiplication tables.

Think of a number. Let's say **276**. Add up the digits: **2 + 7 + 6 = 15**

If the answer has more than one digit, add those up: **1 + 5 = 6**.

Keep going until you have just one digit left. That is the **digital root** of the number you began with.

So, in our example, **6** is the digital root of **276**. Obviously if you begin with a number with just one digit, that is the digital root and you don't have to do anything.

Just to make sure you know what I am talking about, prove to yourself that the digital root of **624** is **3**. I'm sure you understood that very easily. So here's what to do:

Below you will see a multiplication square, but this time all the numbers along the top and down the side are in the right order (not like the practice sheets).

Work out each multiplication and find the digital root of the answer. Then look for patterns. **What do you notice?**

×	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Activity 8: Prime Numbers (1)

You may know by now what a prime number is and how to calculate them. If you don't, this module will teach you all you need to know.

First of all, a prime number is a number that cannot be divided exactly by any number apart from itself and **1**.

For example, **7** is a prime number because it can only be divided by **7** and **1**.

11 is a prime number because it can only be divided by **11** and **1**.

15 is **not** a prime number because it can also be divided by **3** and **5**.

9 is not a prime number because it can be divided by **3**.

(Mathematicians do not think of the number **1** as a prime number. There are some technical reasons for this which I am not going to go into here.)

So the first prime number is **2** because it can only be divided by **2** and **1**. This is, of course, the only even prime number because all the other even numbers can be divided by **2**.

The next prime number is **3** and the next **5**. We already know that **7** and **11** are prime numbers, so let's have a look at our list so far.

These are the prime numbers we have looked at already are: **2, 3, 5, 7, 11**

How can we find the prime numbers that come after these? What we need to do is to test each number to see if any other numbers divide into it (except itself and **1**, of course).

No other numbers divide into **13**, so that must be prime. **15** we already know is divisible by **3** and **5**, so that's not a prime number.

17 is not divisible by other numbers and neither is **19**, so these must be prime too.

21, on the other hand, is divisible by **3** and **7**, so **21** is not a prime number.

So, now we have: **2, 3, 5, 7, 11, 13, 17, 19,**

But what about larger numbers? Isn't it going to take all day to decide if they are prime numbers or not?

Well, there are two things that can help us. When we are testing to see which numbers divide into the number we are testing, we do not have to test every number.

For example, let's suppose we want to see if **91** is a prime number.

First we divide by **2**. We can see **2** will not go into **91**, because **91** is an odd number, so we try dividing by **3**.

3 won't divide into **91**, so we are tempted to divide by **4**. However, if **2** won't divide into **91**, **4** won't either. And nor will **6** or **8** or **10** or **12** or **14** or any other even number.

So now we try **5**. But **5** won't divide into **91** and that means that **10, 15, 20, 25** and so on won't either.

The point is that we only have to try to divide by the prime numbers we already know about.

So we only need to try to divide **91** by **2, 3, 5, 7** etc. If these won't divide into **91**, neither will **4, 6**, **8** and so on.

So that makes life a bit easier, but there is another trick you can use to make it even easier.

To understand this, you need to know about square roots. The square root of a number is the number that when multiplied by itself comes to the number we started with.

For example, the square root of **9** is **3**, because **3 x 3 = 9**.
The square root of **16** is **4**, because **4 x 4 = 16**
The square root of **25** is **5**, because **5 x 5 = 26**.

Do you have the idea?

There's just one small problem. The square roots of most numbers are normally pretty nasty decimals. For example, the square root of **18** is **4.242…**.

But it turns out that this is not a problem. All we need is a rough square root to help us in finding prime numbers.

Going back to our attempt to find out if **91** is a prime number, we first of all get a rough square root of **91**. We know that **9 x 9 = 81** and that **10 x 10 = 100**, so the square root of **91** is a bit more than **9**.

The trick is that we only need to try to divide by the prime numbers we already know **up to the square root of the number we are testing.** So that means that in this case, we only need to try to divide by **2, 3, 5** and **7**. If none of these will divide into **91**, then **91** is a prime number.

This makes the job much easier.

In the case of **91**, we find that **7** divides into it exactly, so **91** is not a prime number.

Let's try another example. We want to find if **263** is a prime number. This is what we do.

First we find the square root of **263**. If you have a calculator you can use that, but if not we can do it on paper. Remember we only want an approximate answer.

Going through the square numbers, **13 x 13 = 169** (too small)
14 x 14 = 196 (closer)
15 x 15 = 225 (better still)
16 x 16 = 256 (very close)
17 x 17 = 289 (too big)

So the square root of **263** is a bit more than **1**6. This means we only have to try dividing by the prime numbers up to **16**.

These are **2, 3, 5, 7, 11** and **13**.

We can see that **263** is not divisible by **2** because it is an odd number.
We can see it is not divisible by **5** because it does not end in **5** or **0**.

So all we have to divide by now is **3, 7, 11** and **13**. Wow! That's a lot easier.

Try dividing **263** by these numbers to see if it is a prime number.

Now you can find out if any number that is not too big is a prime number or not quite easily.

Try these numbers. Are they prime numbers?

67, 93, 87, 97, 101, 127, 143

I'll start you off with the first one. The square root of **67** is about **8** because **8 x 8 is 64** and that's near enough.

So all you have to do is try to divide **67** by the prime numbers less than **8**.
These are **2, 3, 5** and **7**.

You can see straight away that two of these do not divide into **67** (why?), so that only leaves you with a couple of sums to do. Have a go now.

Once you have practised this a bit, you will find that discovering prime numbers is a lot easier than you might think, so why not make a list. You will find it useful later.

Of course, you will find lists of prime numbers on the internet, but where is the fun in that? I can't help feeling that's cheating a bit. But not only that, you will learn much more about prime numbers by working them out yourself. Any idiot can look them up on the internet.

But, once you have worked out all the prime numbers up to **100** (further if you wish), you could look them up just to check, providing you've done all the work yourself first.

You may have guessed that I love prime numbers. The more you find out about them, the more interesting they get. I hope you find the same.

Activity 9: Times Tables and Powers

Have you ever looked at the last digits in the sequence when you multiply a number by itself, then by itself again and by itself again and so on?

No? Well I don't find that surprising, but we can have a look now.

Let's begin with the number **2**.

Obviously **2** ends with **2**, so that's the first number in the sequence.

Multiply **2** by **2** to get **4** and that ends with **4**, so that's the next number in the sequence.

Multiply **4** by **2** to get **8** and that ends with **8**, so that's the next number in the sequence.

Multiply **8** by **2** to get **16** and that ends with **6**, so that's the next one.

Multiply **16** by **2** to get **32** and that ends with **2**, so that's the next one.

We have the sequence:

2, 4, 8, 6, 2 …

Continue the next few numbers in the sequence and see what you get. What is the pattern?

Now try the pattern for multiplying by **3**.

Here are the first two numbers in the sequence:

3, 9 …

What happens next?

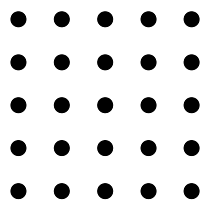
Now try the same thing for all the numbers up to **9** and see what patterns you can see.

Activity 10: Square Numbers (1)

Square numbers are, of course, the answers when whole numbers are multiplied by themselves.

For examples, if we multiply **5 x 5**, the answer is **25**, so **25** is a square number.

Some people like to think of square numbers in a diagram. We can imagine a square with **25** dots, **5** dots long and **5** dots wide. (That's why they are called square numbers, of course).



Can you write down all the square numbers up to **20 x 20**? (if you don't know them, you will have to work them out – without a calculator, naturally)? Here's the first few to get you started:

0 1 4 9

When you have found them all up to **20 x 20** (further if you want), take the differences between each pair and look at the pattern. What do you notice?

I have done a couple for you. (Don't say I'm not helpful.)

0 1 4 9

1 3

Once you have spotted the pattern in the differences, **write down the next four differences**. Use these to **write down the next four square numbers.**

Lastly, check to make sure these new numbers really are square numbers.

You can see how important multiplication tables are. Don't they come into an awful lot of mathematics?

Lastly, we can write the square of a number by putting a little '**2**' to the top right of the number, like this: $\mathbf{5^2}$. So we can write $\mathbf{5^2 = 25}$. (But I guess you knew that already!)

On a computer, writing a small number up high like this is called 'superscript'.

Activity 11: Divisibility Tests

Sometimes we want to know if one number is divisible by another. For example, we need to do this when we are cancelling fractions.

Can we see easily if **6** will divide into **32142** ?

Over the years, people have discovered some ‘Tests for Divisibility’ to help us do this.

Here I am going to go through some of these to help you with this problem. As usual, a good knowledge of multiplication tables really helps.

<u>Test for Divisibility by 2</u>

Obviously, if a number ends in **0, 2, 4, 6 or 8**, the number is even and **2** will divide into it.

Examples: **2** will divide into **56,   3826 and 9000**
but not into **36661, 89 or 2001**

<u>Test for Divisibility by 3</u>

To test if a number is divisible by **3**, we add up all the digits. If the total is divisible by **3**, the whole number is divisible by **3**.

Example: Take the number **45 387**. Add the digits: **4 + 5 + 3 + 8 + 7 = 27**

27 is divisible by **3**, so **45 387** is also divisible by **3**.

<u>Test for Divisibility by 4</u>

If the last two digits of a number are divisible by **4**, the whole number is divisible
by **4**.

Example: Take the number   **8432**.   **4** will divide into **32** (the last two digits), so it will divide into **8432**.

Test for Divisibility by 5

If a number ends in a **0** or a **5**, the whole number is divisible by **5**.

Examples: **25**, **985**, **6320**, and **42280** are all divisible by **5**.
67, 7 000 001 and **873** are not.

Test for Divisibility by 6

If a number is divisible by **2** (which means it must be even) and it is divisible by **3**, the whole number is divisible by **6**.

Example: **72 528** is divisible because it is even and the total of its digits is divisible by **3. (7 + 2 + 5 + 2 + 8 = 24)**.

Test for Divisibility by 7

There is no easy test for divisibility by **7**. The only way to tell is to divide the number by **7** and see!

Test for Divisibility by 8

If the last three digits are divisible by **8**, the whole number is divisible by **8**.

Example: Take the number **57328.** **8** will divide into **328** (the last three digits), so it will divide into **57328**.

Test for Divisibility by 9

If the total of the digits is divisible by **9**, so is the original number.

Example: Take the number 45 387. The total of the digits is **4 + 5 + 3 + 8 + 7 = 27.**
9 divides exactly into **27**, so **45 387** is also divisible by **9**.

Test for Divisibility by 10

If a number ends in a **0**, the whole number is divisible by **10**.

Example: **760** is divisible by **10** because the last digit is **0**.

Test for Divisibility by 11

There is no easy test for divisibility by **11**. The only way to tell is to divide the number by **11** and see!

Tests for divisibility by higher numbers.

From now on you can sometimes test divisibility by using two tests together, rather like we did for divisibility by **6**.

For example, to test for divisibility by **12**, we can test for divisibility by **3** and by **4**.
To test divisibility by **15**, we can test for divisibility by **3** and **5**.

You may need to be a little ingenious, but often you can find a way.

Using the above tests, can you see what numbers will divide into these numbers:

89 360, 672, 87 640, 365 235

These tests are a great help when working with fractions, factors, prime numbers and many other mathematical topics. They work well together with a good knowledge of your multiplication tables, so aren't you glad you know yours?

Activity 12: Repunit Numbers

I bet anything you like (well, not a million pounds, perhaps) you have never heard of Repunit numbers and I also bet you are absolutely fascinated to find out what they are.

Before you can see what type of number they are, you are going to have to do some big sums using (you guessed it!), your multiplication tables again.

Try these sums and see what you notice about the answers:

NO CALCULATORS.

1. 41 x 271

2. 3 x 7 x 11 x 13 x 37

3. 239 x 4649

4. 513239 x 21649

5. (If you still have some energy left you can try this one)
5363222357 x 2071723 (Yikes!)

Now can you see what **Repunit** numbers are (assuming you didn't make any mistakes with the multiplications, of course). If you still haven't worked it out, divide the word **Repunit** into two parts.

To work out some of the very large Repunit numbers you would need a good computer, but you might be able to work out a few that are smaller than the ones I have given here.

Can you find multiplication sums for the first **4** Repunit numbers?

Activity 13: Square Numbers (2)

Now here's a bit of fun using square numbers and those wonderful multiplication tables. (If you are not sure what square numbers are and how to find them, look at the Square Numbers (1) task.)

Firstly, we can try to find groups of three square numbers so that two of them add up to the third.

Here are the first few square numbers:

0 1 4 9 16 25 36 ….

Can you find two of these that add up to one of the others?

Yes, the answer is **9 + 16 = 25**.

We call this group of three square numbers (**9, 16** and **25**) a Pythagorean Triple.

If you have not covered Pythagoras' Theorem at school yet, you will, you will! When you do, you will find these triples quite handy, but for the moment, they are just good fun.

See how many you can find. HINT: You will need a lot more square numbers to get a good range of triples, so JUST FOR ONCE (and only this once), you can use a calculator to find them.

> ***(Note to parents: If your son or daughter uses a calculator for any other work apart from this, no hot milk and chocolate biscuits for them tonight! You may have them instead! And let them sleep with hedgehogs and porcupines – that should teach them!)***

Now, here's something else you can play with.

You know, of course that $\mathbf{8^2 = 8^2}$, but did you know that:

$$\mathbf{8^2 = 7 \times 9 + 1}$$

‘Just a minute’, I hear you scream, ‘where did that come from?

Well guys, it came by taking one less than **8** and one more than **8**, multiplying them together and adding **1**. Clever stuff, eh? Until now, only top British spies knew this.

Let’s try that with another number. Let’s take **12**. You know, of course that **12^2 = 144** (If you didn’t, you do now.)

So let’s take one off **12** and add one to **12**. Multiply the answers and add **1**.

What do we get?

$$12^2 = 11 \times 13 + 1$$

Check to see if this is correct and then complete these statements:

$$9^2 = 8 \times 10 + ?$$

$$4^2 = 3 \times \ldots\ldots..$$

$$17^2 =$$

Try a few of your own to convince yourself it always works.

When you are happy with that, try taking **two** off the number and adding **two** to the number. For example:

$$7^2 = 5 \times 9 + ?$$

What do you have to add on to make this statement true? Try a few more.

Can you work out the pattern for taking off **3** and adding on **3**?

Or **4** or **5** or **6** etc?

Activity 14: Digit Squaring

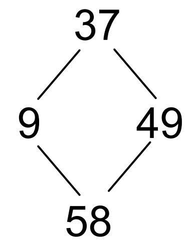
This is a great bit of fun which will focus on your knowledge of square numbers as well as on normal multiplication tables. It is also a good exercise in looking for patterns.

The idea is to make number chains by following a simple rule and this is how this particular rule works:

Think of a number and write it down. Any number will do, but it is best to start with a two digit number as you will soon see.

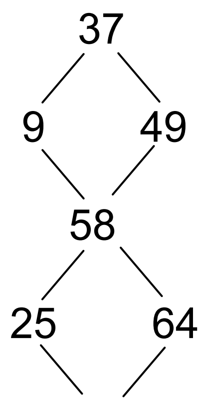
I will choose the number **37**.

The rule is simply to square each of the digits in the number and add them up.



The square of **3** is **9** and the square of **7** is **49** and when we add these we get **58**.

Simple enough, you might think. So now we carry on the chain by doing the same to 58. The square of **5** is **25** and the square of **8** is **64**. The total of **25** and **64** is **89**, so our chain now looks like this:



Occasionally the answer to the total will have just one digit, in which case just square it (so, for example the number **11** will lead to the number **2. 2** squared is **4** and **4** squared is **16** and you are back to two digits again). In some cases you may find you have three digits, in which case square all three and add these up.

Carry on with the chain until you notice some interesting things. For instance, you may notice the same number keeps popping up, so you are going round in circles. You could redraw this bit of the chain as a circle with some other numbers leading into it. I don’t want to do this here as that will be giving the game away.

It is possible to put all the numbers up to 100 (with a few larger than 100 that pop up now and then) into a large diagram, **so that each number appears once and only once**. The question is, ‘’Will this be one large diagram in which every number is connected to another number in the diagram, or will it have several sections that are not joined to the other sections?”

Okay, here’s one tiny clue that may help. Sooner or later you will be using the number **37** in the chain and if you square the digits and add them up, the total is **58**. But, of course, **73** has the same digits as **37**, so when you square them and add them up, the total will be **58** too.

So, on your diagram both **37** and **73** will lead to **58**. In this way, we can gradually include all the numbers.

This will happen to lots of pairs such as **64** and **46**.

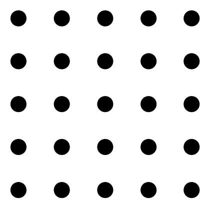
You will need to work very carefully as a few simple errors can mess up the whole investigation.

And you will probably need quite a bit of paper (or you could write very small!).

If you are really nuts, you could count how many calculations you have done from the multiplication table facts. Have fun!

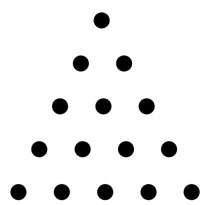
Activity 15: Triangle Numbers

You may know that square numbers are numbers you can arrange in a square of dots. For example **25** is a square number because it can be arranged as a square **5** dots wide and **5** dots long:



But did you know that dots can also be arranged in the shape of triangles to give triangle numbers?

We begin with a row with just one dot, then a row with two dots, then three and so on:



If we look at the first row, there is just **one** dot, so the first triangle number is **1**.

If we look at the first two rows, there are three dots altogether, so the second triangle number is **3**.

The first three rows give us **6** dots and so on. So the triangle numbers are:

1 3 6 10 15 ….

Can you write down the next **10** triangle numbers?

Now here is a bit of algebra for you. Don't panic if you haven't done much algebra yet – I will explain everything as usual.

The formula for triangle numbers is $\frac{n(n+1)}{2}$

n stands for a number. If we want the fifth triangle number, **n** is **5**. If we want the tenth, **n** is **10** and so on.

All we have to do is to put the number for **n** in the formula.

n + 1 in the bracket means add **1** to **n**.

n(n + 1) means multiply the bit in the bracket by **n.**

And the **2** in the denominator of the fraction means divide by **2**.

Let's give it a go:

Suppose we want the 4^{th} triangle number. That means that **n = 4**.

Put the number **4** for **n** in the bracket and add the **1**. That gives us **5**.

So the top row is now **4 x 5**. This equals **20**, of course.

Lastly, we divide by the **2** to get **10**. So the **4th** triangle number is **10**.

And it is! How easy is that.

Let's do it one more time. In the list above, we have the first **5** triangle numbers:
(**1, 3, 6, 10, 15**).

Suppose we want to find the next one in the sequence. That is the **6th** one, so we make **n = 6**.

Put **n = 6** in the bracket and we get **n + 1**, which is **7**.

Multiply that by **n**, so we have **6 x 7**. That is **42**.

Lastly, divide by **2** to get **21**.

So **21** is the sixth triangle number.

Use the formula to find the 7th triangle number.

Now you have the idea, can you use the formula to find the **20th** triangle number?

Can you find the **50th**?

No Calculators

Can you find the **124th** ?

What is the **largest triangle number** you can find?

Activity 16: Times Tables and Factors (2)

Once you know how to find factors and prime factors, you can do all sorts of things with them. If you are not sure about these ideas, look back at the earlier tasks.

In this task, we are going to see how to find the **HCF** and **LCM** of two numbers.

<u>First the **HCF**.</u>

HCF stands for **Highest Common Factor**.

Think about two numbers such as **48** and **60**. There are lots of numbers that will divide exactly into both **48** and **60**. These are **1, 2, 3, 4, 6** and **12** and so these are all **Common Factors** because they are factors that are common to both
48 and **60**.

What we are trying to find is the **Highest Common Facto**r and if we look at this list, we can see this must be **12**.

<u>In other words, **12** is the highest number that will divide exactly into both **48** and **60**</u>.

The thing is that this is quite easy to see if the numbers are not too difficult. But what about more difficult numbers such as **15400** and **10920**. Not so easy now!

What we need is a method that always works and always finds the **HCF** without any BIG TROUBLE.

Before we try those two whopping big numbers, let's try the method with **48** and **60** to see that it really does work.

What we do is to calculate the prime factors of each number. If you are not sure how to do this, study the Prime Numbers (2) task.

To find the prime factors of **48** we can either use the division method or the factor tree method. I shall use the division method:

2)<u>48</u>
2)<u>24</u>
2)<u>12</u>
2)<u> 6</u>
3)<u> 3</u>
1 So the prime factors of **48** are **2, 2, 2, 2** and **3**

Now do the same for **60**:

2)<u>60</u>
2)<u>30</u>
3)<u>15</u>
5)<u> 5</u>
1 So the prime factors of **60** are **2, 2, 3** and **5**

Look at the two sets of prime factors:

48: **2, 2, 2, 2** and **3**
60: **2, 2, 3** and **5**

What we do now is to select the factors that appear in **both** lists. These are: **2, 2** and **3** and we multiply them together.

2 x 2 x 3 = 12 and this gives us the Highest Common Factor as we discovered earlier.

Now we know that it works, let's try this method on those two huge numbers **15400** and **10920**.

2)<u>15400</u>
2)<u> 7700</u>
2)<u> 3850</u>
5)<u> 1925</u>
5)<u> 385</u>
7)<u> 77</u>
11)<u> 11</u>
1

Although this is a large number, it factorised easily as it is made up of **2**'s, **5**'s and **77** which is obviously **7 x 11**

So the prime factors of **15400** are **2, 2, 2, 5, 5, 7** and **11** (check by multiplying them together: **2 x 2 x 2 x 5 x 5x 7 x 11 = 15400**)

Now do the same with **10920**

2)10920
2) 5460
2) 2730
3) 1365
5) 455
7) 91
13) 13
1

Here we used the test for divisibility by **3**:
1 + 3 + 6 + 5 = 15 which is divisible by **3**,
so **1365** must be divisible by **3** too.

The rest was easy.

So the prime factors of **10920** are **2, 2, 2, 3, 5, 7** and **13**.

Now we have the two sets of prime factors:

15400: **2, 2, 2, 5, 5, 7** and **11**

10920: 2, 2, 2, 3, 5, 7 and **13**

Which factors are in both groups?

The answer is **2, 2, 2, 5** and **7**.

Multiply these together to get **2 x 2 x 2 x 5 x7 = 280**

So **280** is the **Highest Common Factor** of **15400** and **10920**. This means that **280** is the largest number that will divide exactly into the two big numbers. You won't find a bigger one!

You would have had a job to work that out any other way and it wasn't very difficult because all we had to do really was divide by easy numbers such as **2, 3, 5**, and **7**. You will be very familiar with these from practising the multiplication tables.

Now it's your turn. Use this method to find the **HCF** of these pairs of numbers:
(Even if you can see the answer to the smaller numbers, practise the method so that you know what you are doing when you get to the bigger numbers.)

60 and **90**, **54** and **63**, **5775** and **4095**, **5775** and **4095**

If you feel you can face it, try this one with three numbers. Find the prime factors as before and see **which ones are in all three groups**. When you have them, multiply them together as before and Bob's your uncle.

3000, **1980** and **10500**

It looks horrific, but just follow the method and you will be surprised how easy it is!

Now let's take a look at the **LCM**.

LCM stands for **Lowest Common Multiple**. Take the numbers **12** and **15**, for example. There are lots of multiples of each:

Multiples of **12: 12, 24, 36, 48, 60, 72, 84, 96, 108, 120, 132 …**
Multiples of **15: 15, 30, 45, 60, 75, 90, 105, 120, 135 …**

There are some multiples that are the same for both. The first two are **60** and **120**.

It is not too difficult to see that the next is **180** and the one after that is **240** and so on.

When you are finding the **LCM**, you want the lowest of these, which in this case is **60**.

So **60** is the Lowest Common Multiple of **12** and **15**.

<u>In other words, **60** is the smallest number that both **12** and **15** will divide into exactly.</u>

Again we need a proper method for finding the **LCM**, especially when the numbers are large.

Let us use the two numbers we began with: **48** and **60**.

What is the **LCM** of **48** and **60** ?

We use the prime factors again and fortunately we have already worked them out:

So the prime factors of **48** are **2, 2, 2, 2** and **3** and the prime factors of **60** are **2, 2, 3** and **5**

What we do now is to take all the prime factors of one of the numbers and add to this list any in the other list that have not been included.

Let's begin by writing down the prime factors of **48**:

2, 2, 2, 2, 3

Looking at the list for **60**, we can see that we have an extra **5** that is not in the **48** list, so we add it to the list.

This gives us: **2, 2, 2, 2, 3, 5**

Now all we do is to multiply these together:

2 x 2 x 2 x 2 x 3 x 5 = 240

So **240** is the **LCM** of **48** and **60**.

<u>To put it another way, **240** is the smallest number that both **48** and **60** will divide into exactly.</u>

I think this is a very clever method and it always works. Perhaps the person who thought of it deserves a medal. Unfortunately, it wasn't me!
Let's try this now with our two whopping numbers **10920** and **15400**.

We have already worked out the prime factors of these two numbers, so that will save us some work:

10920: 2, 2, 2, 3, 5, 7 and **13**

15400:   **2, 2, 2, 5, 5, 7** and **11**

Again, we write down all the numbers in one group:

2, 2, 2, 3, 5, 7, **13**

And we add any in the other group that we have not already included.

We need to be careful here. We already have **three 3**'s and there are **three 3**'s in the second group, so that's alright.

But we only have one **5** in the first group and there are **two** in the second group, so we need to add another:

2, 2, 2, 3, 5, <u>5</u>, 7, **13**

We have **one 7** in each group, so that's alright.

We have **11** in the second group that is not in the first group, so we need to add it to our list.

2, 2, 2, 3, 5, 5, 7, **<u>11</u>, 13**

In case you are wondering, we have a **3** in the first group that is not in the second, but we have already included that, so we have finished.

Now all we have to do is multiply the numbers in this list together:

2 x 2 x 2 x 3 x 5 x 5 x 7 x 11 x 13 = 600 600

So, there we are. The smallest number that both **10920** and **15400** will divide into exactly is **600 600**. Who would have thought it would turn out to be such a beautiful number? I must admit that I was surprised too.

Now try to find the **LCM** of the numbers you used to work out the **HCF's**. Here they are again:

60 and **90**, **54** and **63**, **5775** and **4095**, **5775** and **4095**

3000, **1980** and **10500** **Have loads of fun with this, but work carefully.**

Activity 17: Prime Numbers (2)

You know by now what a prime number is and how to calculate them. (If you don't, please go back to Prime Numbers (1) and have a go at that task first).

Here we are going to take a look at a few interesting ideas relating to prime numbers.

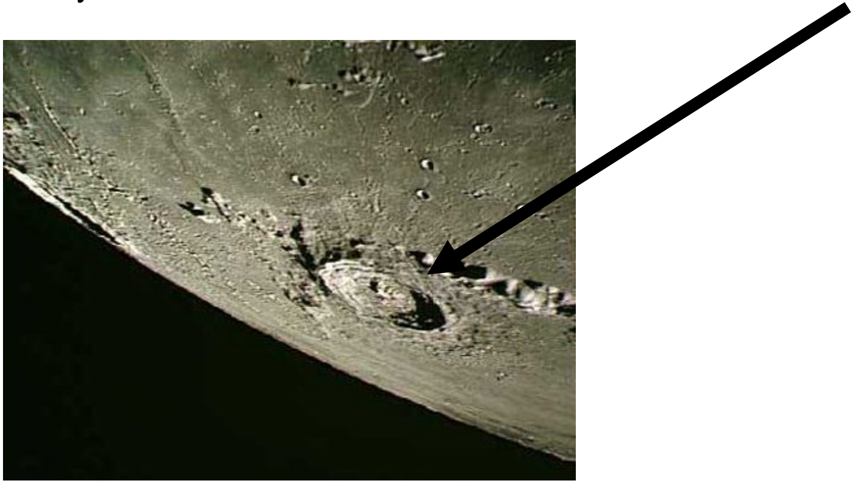
Sieve of Eratosthenes (pronounced E – RA – TOS – THE – KNEES)

Eratosthenes was a very interesting person and he lived from 276 BC until 195 BC (approximate dates). Can you work out how old he was when he died?

He lived in a place called Cyrene, which was a Greek colony in those days.

He was the first person to measure the size of the Earth and the tilt of the Earth's axis, which he did very accurately. He was the first person to use the word 'geography'. He invented a system of latitude and longitude. He produced a map of the world based on the knowledge people had at the time. He was also a poet and a good athlete.

Today he has a crater on the Moon named after him and here it is:



Here is a picture of Eratosthenes.

Handsome chap, don't you think?

And, of course, he invented a type of sieve for finding prime numbers. One thing you may have noticed is that prime numbers do not appear in the multiplication table except where they are multiplied by 1.

Eratosthenes used this idea to show how you could find the prime numbers.

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

Follow this simple set of instructions:

Cross out the number 1 because 1 is not a prime number.

Leave the number 2 and cross out every multiple of 2 after that.
Leave the number 3 and cross out every multiple of 3 after that.
Leave the number 5 and cross out every multiple of 5 after that.

(We missed out 4, of course, because all the multiples of 4 were crossed out when we crossed out the multiples of 2)

Leave the number 7 and cross out every multiple of 7 after that.

If you want to check, your table should now look like this:

	2	3		5		7			
11		13				17		19	
		23						29	
31						37			
41		43				47			
		53						59	
61						67			
71		73						79	
		83						89	
						97			

You may have made a table that went beyond the number 100. If you did, you may still have some numbers to cross out, but if you stopped at 100, you will find that all the numbers left in the table are prime numbers.

How do you know which numbers to use for crossing out? It should be obvious when you look at the table. We have used 2, 3, 5 and 7, which are the first numbers left in the table.

If you want to try a larger table, the ne3xt number to use for crossing out would be 11 (Leave the number 11 and cross out every multiple of 11 after that).

The next would be 13 and so on. The numbers to use are the prime numbers you are finding, so what could be easier?

Just for fun, why not make a table that goes up to 200 and use Eratosthenes' idea to find the prime numbers up to 100. If you want to go on to the tasks in Prime Numbers (3), this will be a very useful list to have!!!!!!!!!!!!!!!

Twin Primes

Notice that sometimes we just say 'primes' instead of 'prime numbers'. Mathematicians are so lazy, they often spend years trying to make things simpler to do, so it is no wonder they find it difficult to say 'prime numbers' and say 'primes' instead.

(In case you didn't realise, there's a joke there somewhere).

Okay so what are twin primes. Well, it's a very easy idea. Twin primes are pairs of prime numbers that are just two numbers apart. If you look at your list of prime numbers, you will see

11 and **13**,

17 and **19** and so on. Each pair are just two numbers apart. How many pairs of twin primes can you find?

If you are interested, the largest known twin primes were discovered in 2009 and have **100 355** digits in each! (So I won't write them down here.)

While I am talking about large prime numbers, you may be wondering what the largest known prime number is. This has **12 978 189** digits. If I could write it down and you read it out, without stopping at one digit every second, it would take you over 150 days – that's nearly 5 months!

Prime Factors

You will find it very useful to be able to find the prime factors of a number as these will come into your later mathematical work. This is a good application of multiplication tables.

You already know what factors are.
For example, the factors of **60** are **1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30** and **60**.

Prime factors are the factors that are prime numbers, so looking for the prime numbers in our list, we can see **2, 3** and **5**. This means that the prime factors of **60** are **2, 3** and **5**.

That sound easy enough, but mathematicians sometimes want to know how many **2**'s you need and how many **3**'s you need and how many **5**'s you need to make **60**.

If you think about it for a little while, you will see you need two **2**'s, one **3** and one **5** to make **60** like this:

60 = 2 x 2 x 3 x 5

But what are prime factors of a number like 7560? It's not quite so easy now, I am sure you will agree. What we need is a method that will always give us the prime factors quickly and easily. There are two main ones you can use, **the division method** and **the factor tree**.

Let's look at the division method first.

Division method

This method consists of making a number of divisions using the prime numbers to divide by.

I start by asking myself, 'What is the smallest prime number that will divide into **7560**?', and I think you will soon realise that the answer is **2**, because **7560** is an even number.

So we divide **7560** by **2**

2)7560
3780

Now we ask the same question. What is the smallest prime number that will divide into 3780? Again it is **2** because **3780** is an even number. So we do the division.

2)3780
1890
Same again – the smallest prime number that will divide into **1890** is **2**, so we divide.

2)1890
945

Aha! An odd number, so we can't divide by **2** any more. What's the next prime number that will divide into **945**. Adding the digits **9 + 4 + 5 = 18** and using the divisibility test for three, we can see that **3** will divide into **945**, so let's do that.

3)945
315

And again.

3)315
105

And again.

3)105
35

The next smallest prime number that will divide into **35** is **5**, so we divide by **5**.

5)35
7 and **7** is a prime number, so we are finished.

Which numbers have we divided by? Let's make a list:

2, 2, 2, 3, 3, 3, 5, 7 (Notice we include the final prime factor, **7**)

So we have found all the prime factors of **7560** and we can see that
7560 = 2 x 2 x 2 x 3 x 3 x 3 x 5 x 7, so that's it. Well done us!

If we take out all the explanation, we can write all the working as one very long division sum, like this:

2)7560
2)3780
2)1890
3) 945
3) 315
3) 105
5) 35
7) 7 (Some people like to continue until they reach 1 in the last division, so I have
1 done that here)

Now all we need to do is to read down the left hand column – **2 x 2 x 2 x 3 x 3 x 3 x 5 x 7 = 7560**

Why not try it yourself and find the prime factors of these numbers:

2100, 3850, 875, 11025

The great thing about this method is that as the number you are dividing **by** gets bigger, the number you are dividing **into** gets smaller, so it normally gets easier as you get towards the end.

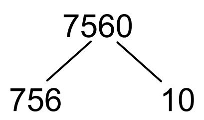
Now let’s look at the Factor Tree method:

Factor Tree

The factor tree is a method that generally works well for finding the prime factors of bigger numbers, but can take up a lot of space on your page.

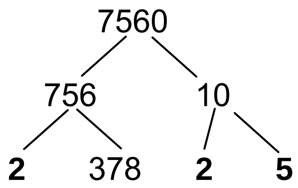
We start by finding any two numbers that multiplied together come to the number we are trying to factorise. Using our number **7560**, we can easily see that **7560 = 756 x 10**. It doesn’t matter at this stage that neither of these number is a prime number.

We draw this on a diagram like this:



Next we try to find numbers that divide into **756**. This is a bit tricky as this is a difficult number, but we do know that **2** goes into it because it is prime. We divide **2** into **756** to get **378** and we put this on our diagram. We also know that **10 = 2 x 5**, so we can put these on the diagram at the same time.

The tree diagram now looks like this:

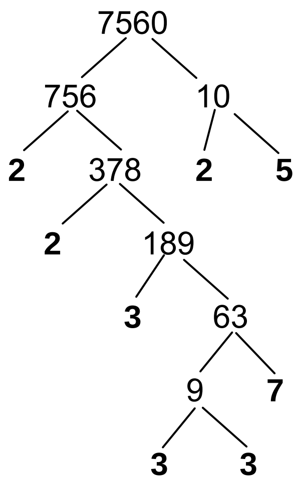


Each time we find a prime number, we write it in bold. You may like to put a circle around it.

So far we have found **2, 2** and **5**.

When we find a prime number, that branch of the tree is finished, so we concentrate now on the number **378**.

Again this is even, so we divide by **2** and the answer is **189**. This is divisible by **3**, so we divide it by **3**. When we have finished, the tree looks like this:



Make sure you understand what we have done here because you are going to need it later.

If we look at the prime numbers again, we see we have the same group as before:

2 x 2 x 2 x 3 x 3 x 3 x 5 x 7 = 7560 (We may have to write them in a different order)

For numbers like **7560** this method can be a bit harder than the division method, but sometimes it is very easy. Try, for example, finding the prime factors of **600**. (Clue: We can see straight away that **600 = 20 x 30**, so these numbers go on the first branches of the tree.)

Then try these numbers: **48, 1000, 64, 270**

How many prime numbers are there?

There are an infinite number of prime numbers. In other words, they go on for ever and ever and ever and ever and ever and ever and even further than you could ever imagine. This has been known for a long time, but you may be interested in knowing how many prime numbers there are lower than 100 or 1 000 or 10 000 etc.

The table below tells you all you need to know. I have missed out the number up to 100 because you can use your sieve of Eratosthenes to count for yourself.

Up to	**There are this number of primes**	**Percentage of numbers that are prime**
1 000	**168**	**16.8%**
10 000	**1 229**	**12.29%**
100 000	**9 592**	**9.592%**
1 000 000	**78 498**	**7.8498%**
10 000 000	**664 579**	**6.664579%**
100 000 000	**5 761 455**	**5.761455%**

So, for example, there are 9 592 prime numbers up to the number 100 000.

The third column tells you what percentage of all the numbers are prime numbers. So, for example, 12.29% of all numbers up to 10 000 are prime numbers, but this has shrunk to 5.761455% for all the numbers up to 100 million.

This is interesting because it tells us that as we go up the number line, prime numbers get further apart. Well, what do you know?

Okay, guys, that may be all you can stomach about prime numbers for now and you may feel you have had lots of practice with the multiplication tables, but if you think you can take even more, you might like to try the third module on Prime Numbers which you will find in the Higher level tasks. But be prepared to have your brain really stretched!!!!!!!!!

P.S. Going back to Eratosthenes having a crater on the Moon named after him, all the other people who have craters named after them are dead. All except one, that is. Can you find out who it is?