

Miscellaneous

List of Contents

Find ...

Converting Units

Problems with Units

Square - sum Links

Odd One Out

Divisibility

Find ...

1. ... the sum of all the whole numbers from 1 to 50 (include 1 and 50)
2. ... the number which, when multiplied by itself, gives the answer 1225
3. ... two consecutive numbers which, when added together, make 37
4. ... two consecutive numbers which, when multiplied together, make 462
5. ... three consecutive numbers which, when added together, make 78
6. ... three consecutive numbers which, when multiplied together, make 2184
7. ... three consecutive numbers which, when added together, make 1368
8. ... two consecutive numbers whose squares, when added together, make 545
9. ... two consecutive numbers whose squares, when subtracted, make 47
10. ... two consecutive even numbers whose sum is 58
11. ... three consecutive odd numbers whose sum is 177.
12. ... two consecutive odd numbers which, multiplied together, make 19 043
13. ... two numbers which, added together make 62 and, when subtracted, make 12.
14. ... two numbers which, added together make 20 and, multiplied together make 84
15. ... two numbers which, when subtracted give 4 and, when multiplied together make 437
16. ... two numbers whose sum is 100 and whose product is 2475
17. ... two numbers whose sum is 70 and whose product is 1081
18. ... two numbers whose difference is 49 and whose product is 3182
19. ... the number which, when cubed gives the answer 4913
20. ... two whole numbers (neither of which is 1) which, when multiplied together make 91
21. ... two whole numbers (neither of which is 1) which, when multiplied together make 703
22. ... the number whose square is bigger than its half by 95
23. ... the number whose cube is bigger than its square by 294
24. ... two consecutive prime numbers which, when multiplied together make 3127
25. ... three consecutive prime numbers whose sum is 349.

Converting Units

For each of these statements, convert each of the measurements given on the left into its equivalent (or approximately equivalent) measure in the units stated on the right.

| | | | | | | | | | |
|------|-----------------|---|-------|-----------------|------|-------------------|---|-------|--------------------|
| 9 | inches | ≡ | _____ | mm | 4 | cu. inches | ≡ | _____ | cm ³ |
| 9 | inches | ≡ | _____ | cm | 100 | cm ³ | ≡ | _____ | cu. inches |
| 4.7 | inches | ≡ | _____ | cm | 4 | litres | ≡ | _____ | pints |
| 5.3 | inches | ≡ | _____ | mm | 50 | litres | ≡ | _____ | gallons |
| 17 | inches | ≡ | _____ | cm | 8 | gallons | ≡ | _____ | litres |
| 21.5 | inches | ≡ | _____ | cm | 150 | fl. ounces | ≡ | _____ | pints |
| 18 | cm | ≡ | _____ | inches | 36 | pints | ≡ | _____ | gallons |
| 2.3 | cm | ≡ | _____ | mm | 3.5 | gallons | ≡ | _____ | pints |
| 45 | mm | ≡ | _____ | inches | 2.5 | litres | ≡ | _____ | fl. ounces |
| 76 | mm | ≡ | _____ | cm | 4 | ounces | ≡ | _____ | grams |
| 53 | cm | ≡ | _____ | inches | 10.4 | ounces | ≡ | _____ | grams |
| 2 | feet | ≡ | _____ | cm | 1 | pound | ≡ | _____ | kg |
| 2 | metres | ≡ | _____ | feet | 1.7 | pounds | ≡ | _____ | kg |
| 1.3 | metres | ≡ | _____ | feet | 2300 | grams | ≡ | _____ | kg |
| 1.8 | metres | ≡ | _____ | cm | 5.6 | kg | ≡ | _____ | grams |
| 260 | cm | ≡ | _____ | metres | 3.7 | kg | ≡ | _____ | pounds |
| 3.4 | km | ≡ | _____ | metres | 1 | tonne | ≡ | _____ | pounds |
| 76 | km | ≡ | _____ | miles | 4.5 | tonnes | ≡ | _____ | kg |
| 20 | miles | ≡ | _____ | km | 14 | tonnes | ≡ | _____ | tons |
| 10 | sq. inches | ≡ | _____ | cm ² | 40 | tons | ≡ | _____ | tonnes |
| 87.4 | sq. inches | ≡ | _____ | cm ² | 5 | tons | ≡ | _____ | pounds |
| 20 | cm ² | ≡ | _____ | sq. inches | 4.5 | m ³ | ≡ | _____ | gallons |
| 20 | cm ² | ≡ | _____ | mm ² | 7400 | litres | ≡ | _____ | m ³ |
| 500 | m ² | ≡ | _____ | ares | 2.7 | hectares | ≡ | _____ | yard ² |
| 3400 | acres | ≡ | _____ | sq. miles | 1.3 | metres | ≡ | _____ | inches |
| 3.5 | sq. miles | ≡ | _____ | acres | 15 | km ² | ≡ | _____ | miles ² |
| 10 | acres | ≡ | _____ | hectares | 14.8 | miles | ≡ | _____ | metres |
| 3 | hectares | ≡ | _____ | acres | 8.1 | feet ³ | ≡ | _____ | litres |
| 4.58 | hectares | ≡ | _____ | m ² | 9.63 | m | ≡ | _____ | mm |
| 1000 | hectares | ≡ | _____ | sq. miles | 30 | gallons | ≡ | _____ | litres |

Problems with Units

Slowly the world is standardising on 'metric' measures (more correctly, the SI system), but it will take a long time and meanwhile, we have to go on living in a world of dual-measures. These problems present situations that could arise, either in ordinary everyday life or in connection with a job. Note that some of these problems, as worded, have an ambiguity about them - decisions will have to be made (and stated).

1. I want to buy 150 feet of garden hose, but it is sold in metres (to the nearest 10 centimetres). How many metres must I buy?
2. In athletics the 1500 metres race is often referred to as the "metric mile". By how many metres is it shorter than a mile?
3. A carpet is advertised as costing £10.50 per square yard. You want to use the carpet to cover the floor of your sitting-room which measures 2.8 metres by 3.7 metres. How much will it cost?
4. The petrol tank of a car is said to hold 40 gallons but, since petrol stations now sell by the litre, the owner needs to know how many litres the petrol tank will hold. Can you help?
5. Granny's old recipe book says you need a temperature of 450 degrees Fahrenheit, but your oven is only marked for degrees Celsius. What temperature will you use?
6. The house you are going to stay at for your holiday has a garden area of 30 ares. How does it compare with your half-acre at home?
7. It is said that a cockroach can move at 85 cm per second. How fast is that in miles per hour?
8. A pump is needed to deliver 350 gallons per hour. The sales brochure offers four different sizes of pumps: 500, 1000, 2000, and 5000 litres per hour. Which would be the most suitable?
9. How does a new car doing 8.5 miles per litre compare with an older car which did 40 miles to the gallon; and then with another car which is said to need only 7.5 litres per 100 kilometres?
10. A garden covers half an acre. How many gallons of water does it need to equal a rainfall of 5 mm?
11. What is the difference between a short ton, a long ton, and a metric ton or tonne?
12. One of the highest rainfalls ever recorded was that of 73 inches in 24 hours. How many tonnes of water per hour was that on every hectare?
13. How many tons of fertilizer are needed for a 17 acre field when the recommended spreading rate is 850 kg per hectare?
14. How many millilitres of chemical-X do you need to add to one gallon of water to get a solution with a concentration of 650 parts per million?
15. What setting will a mechanic need to use on an old torque-wrench (marked in pounds-feet) when the manual says a setting of 20 newton-metres is needed?
16. A car manual says that the tyre pressures should be 1.7 bars. The only gauge available reads in pounds per square inch. Can you find the correct equivalent pressure?
17. A new car is advertised as having a power rating of 70 kW. How does that compare with a car which had a rating of 85 horse-power?
18. What size of electric central-heating boiler (in kilowatts) would be needed to replace a gas-fired boiler which is rated at 70 000 Btu per hour?
19. Given that £1 is worth about 2 000 lire, how many £'s does it take to become an Italian 'millionaire'?
20. The oil well at the bottom of your garden is producing 10 gallons an hour. The financial page of your paper gives the price in dollars per barrel. Can you work out how much money you might get each year?

Square - sum Links

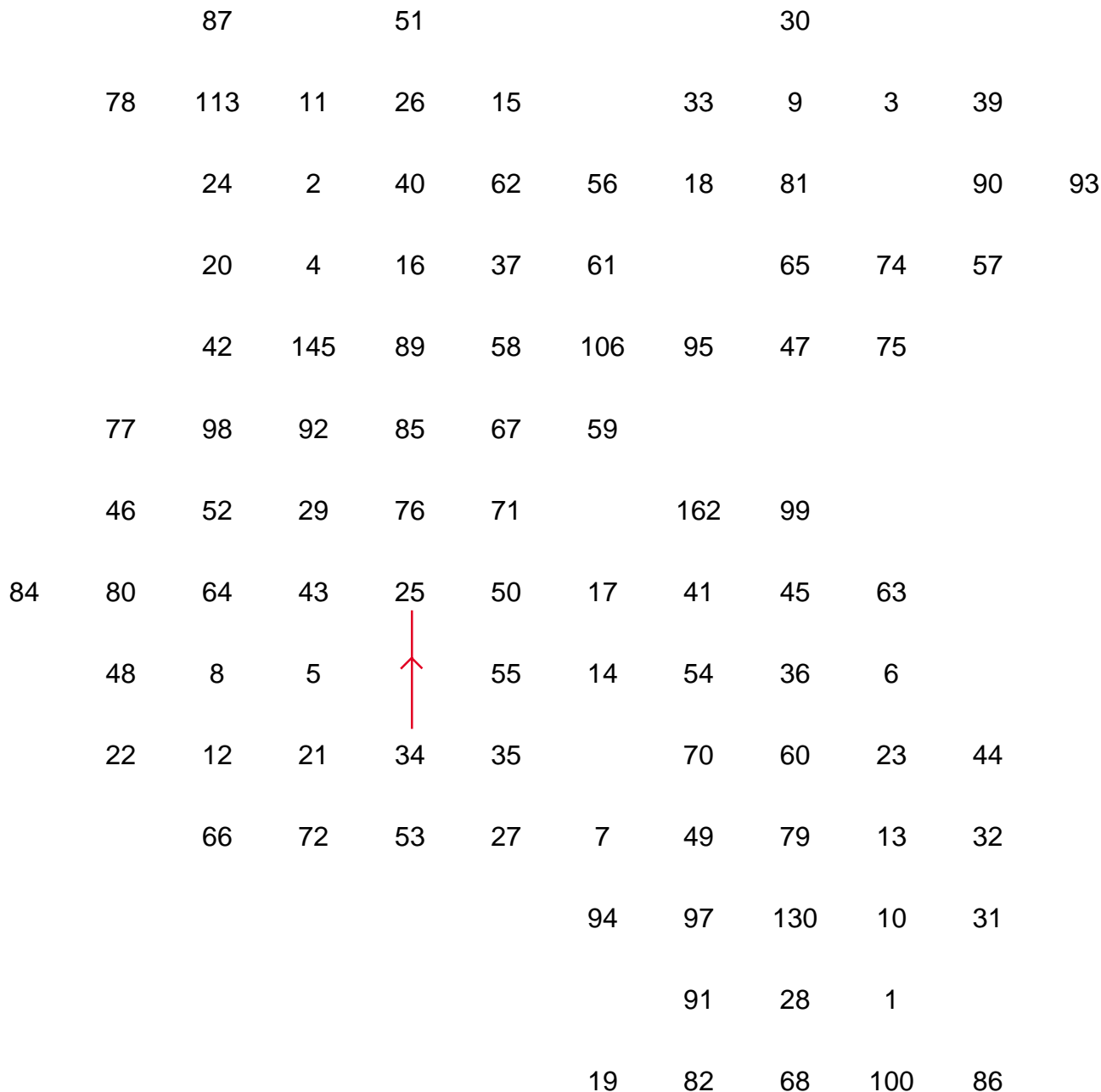
A square-sum link is made by taking a number, breaking it up into its separate digits, squaring each of the digits and adding them together to make a new number. The link is then made by drawing a line (with an arrow to show its direction) from the first number to the second.

For example, on the diagram below a start has been made with 34.

It is first broken into 3 and 4. Then $3^2 + 4^2 = 9 + 16$ which makes 25, and the link is drawn from 34 to 25.

Complete the diagram below by making all the square-sum links possible.

As a check, no links should ever cross each other, and nor should they need go around other numbers.



On completion, study the links. Notice that, **no matter at which number you start**, if you follow all the links leading onwards in the direction of the arrows, then you finish up doing one or other of two things.

What are those two things?

Odd One Out

How familiar are you with the numbers?

Given the set of numbers:

2 16 24 35

and asked to choose the odd one out, or the one that does not seem to belong to the set, many people choose 35 because it is the **only** odd number.

In fact it is possible to find a reason for any one of them **not** belonging to the set. For instance:

2 does not belong because it is the **only** prime number.

16 does not belong because it is the **only** square number.

24 does not belong because it is the **only** multiple of 3.

35 does not belong because it is the **only** odd number.

1. Find a **different** set of reasons for each one **not** belonging to the above set.
2. For each of the following sets of numbers find **at least one** reason for each of the numbers **not** belonging to that set.

(a) 17 18 35 49

(b) 2 12 14 27

(c) 24 32 50 56

(d) 15 29 30 33

(e) 23 28 49 56

3. Make a list of as many **different** reasons as possible as to why numbers might **not** belong to a set. Organize the list so that those reasons of a similar type are grouped together.
4. Write out as big a set of numbers as possible, together with reasons as to why each member of that set could be said to be '**the odd one out**'.

Divisibility

Test each of these numbers in turn to see if it is **exactly** divisible by 2, 3 or 5, and put a tick or a cross in the appropriate column to show whether it is or not.

| Number is exactly divisible by - | | | |
|----------------------------------|---|---|---|
| | 2 | 3 | 5 |
| 24 | ✓ | ✓ | ✗ |
| 17 | | | |
| 25 | | | |
| 27 | | | |
| 30 | | | |
| 36 | | | |
| 18 | | | |
| 39 | | | |
| 45 | | | |
| 72 | | | |
| 63 | | | |
| 12 | | | |
| 80 | | | |
| 75 | | | |
| 102 | | | |
| 96 | | | |
| 21 | | | |
| 44 | | | |
| 87 | | | |
| 95 | | | |
| 123 | | | |
| 150 | | | |
| 147 | | | |

| Number is exactly divisible by - | | | |
|----------------------------------|---|---|---|
| | 2 | 3 | 5 |
| 138 | | | |
| 204 | | | |
| 175 | | | |
| 141 | | | |
| 375 | | | |
| 420 | | | |
| 567 | | | |
| 605 | | | |
| 713 | | | |
| 132 | | | |
| 83 | | | |
| 48 | | | |
| 162 | | | |
| 126 | | | |
| 216 | | | |
| 621 | | | |
| 612 | | | |
| 261 | | | |
| 375 | | | |
| 270 | | | |
| 112 | | | |
| 963 | | | |
| 964 | | | |

| Number is exactly divisible by - | | | |
|----------------------------------|---|---|---|
| | 2 | 3 | 5 |
| 971 | | | |
| 1001 | | | |
| 1002 | | | |
| 19 | | | |
| 865 | | | |
| 762 | | | |
| 15 | | | |
| 51 | | | |
| 754 | | | |
| 28 | | | |
| 1562 | | | |
| 2160 | | | |
| 5154 | | | |
| 3621 | | | |
| 7413 | | | |
| 6215 | | | |
| 8100 | | | |
| 4902 | | | |
| 1703 | | | |
| 9012 | | | |
| 703 | | | |
| 417 | | | |
| 8934 | | | |