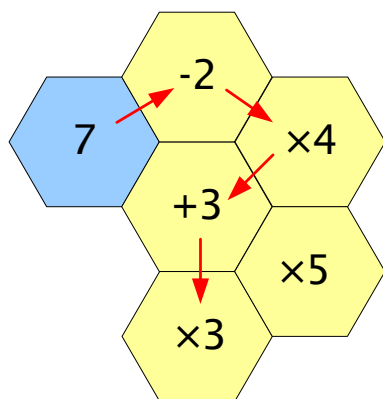


Above is a board. You have to work out a route which will allow you to land on the final blank blue square with a particular target number. You always start at the blue 7. You are allowed to move onto any adjacent hexagon and your 7 will alter accordingly. You are only allowed to visit each hexagon a maximum of once.



On this route:

$$7 - 2 = 5$$

$$5 \times 4 = 20$$

$$20 + 3 = 23$$

$$23 \times 3 = 69$$

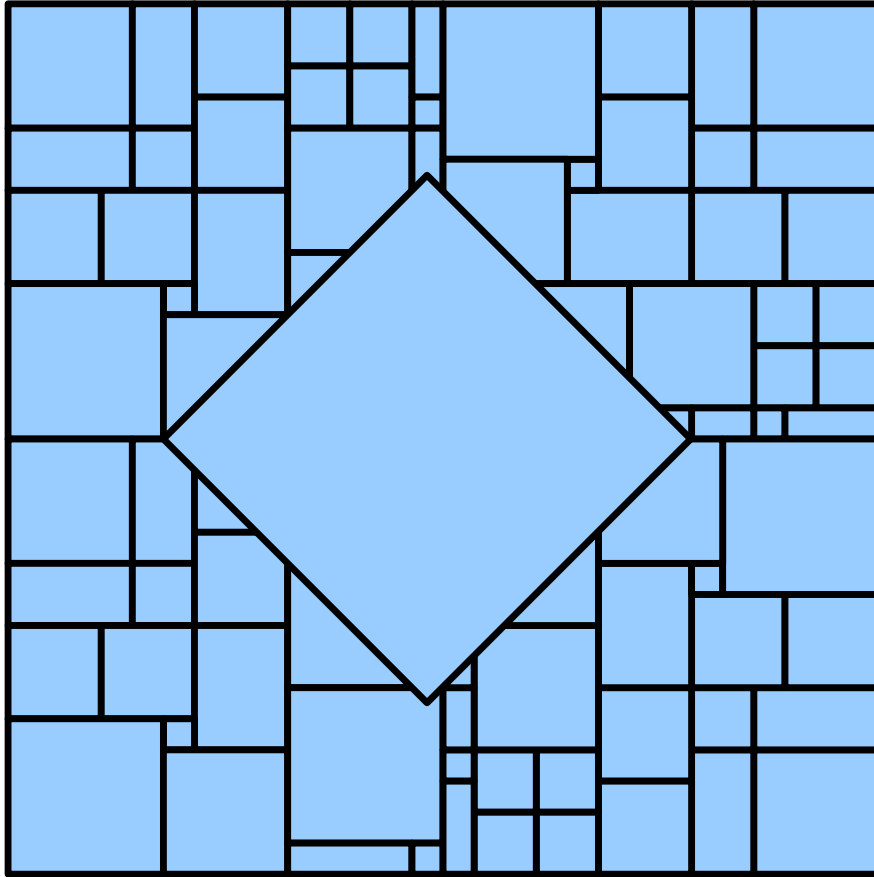
The aim of the exercise is to pick a route which will allow you to finish in the blue hexagon with a target amount.

See if you can calculate a route that allows you to finish with final score of 410.

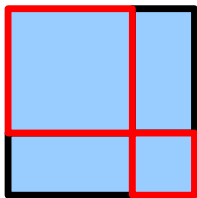
What is the minimum score you can find to get through the path?

What is the maximum score you can find to get through the path?

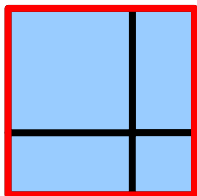
How many routes are there that allow you to land on the blue square with an integer?



How many squares can you count in this picture?

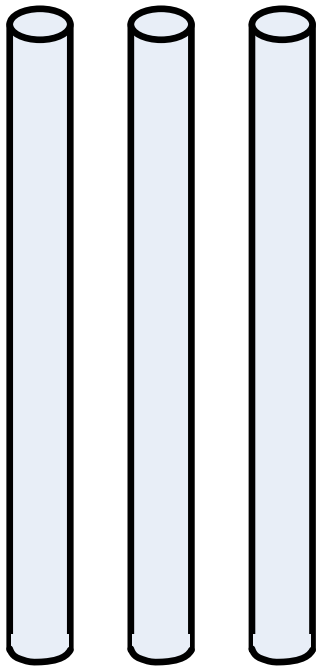


Be careful: We have chosen a section which appears to have 2 squares but there are actually three!



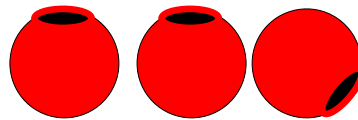
There is a square all the way round the edge as well!!

An abacus is a way of counting and calculating. People who learn to use an abacus become really adept at manipulating numbers.



To count on an abacus, you put beads over the top of one of three rods (in this case).

The left hand rod is the hundreds column, the middle one is the tens column and the right hand one is the units column.

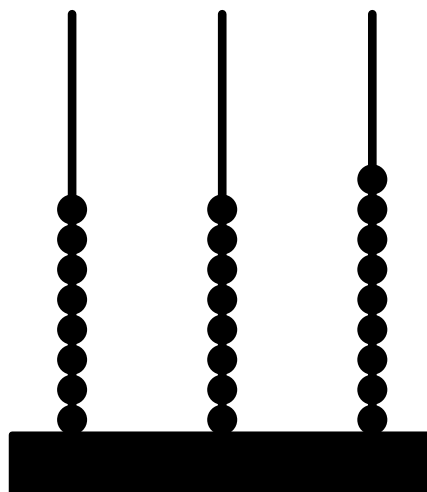


You have twenty-five beads. You must use all twenty five beads and place them on the abacus. What different numbers can you come up with when using a three column abacus? Put the numbers in order. You cannot use more than 9 counters in one column.

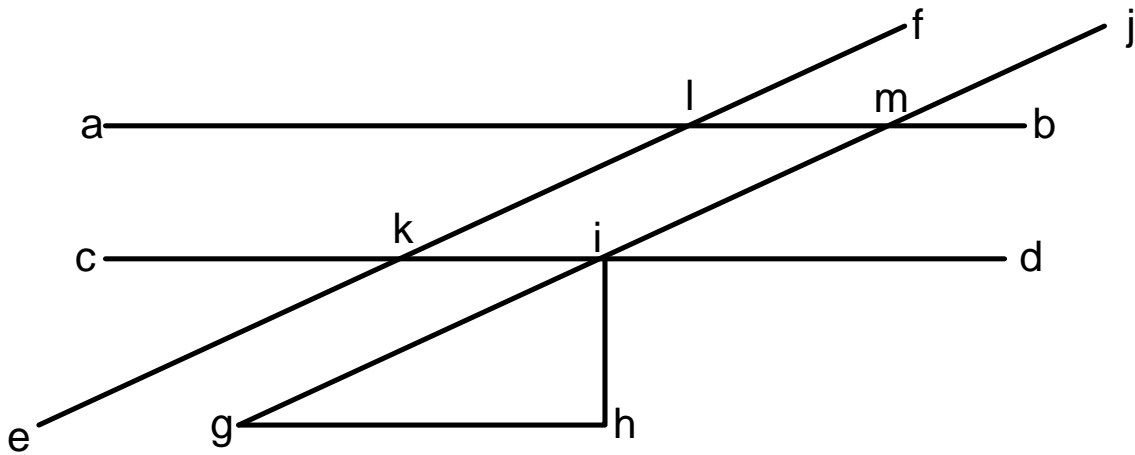
What is the range of the numbers that you come up with?

What is the mean and median numbers you come up with?

Try the same process again, but this time, have a thousand column as well as the HTU. Each time, as a check, the digits should all add up to 25.



Shape: Part A.

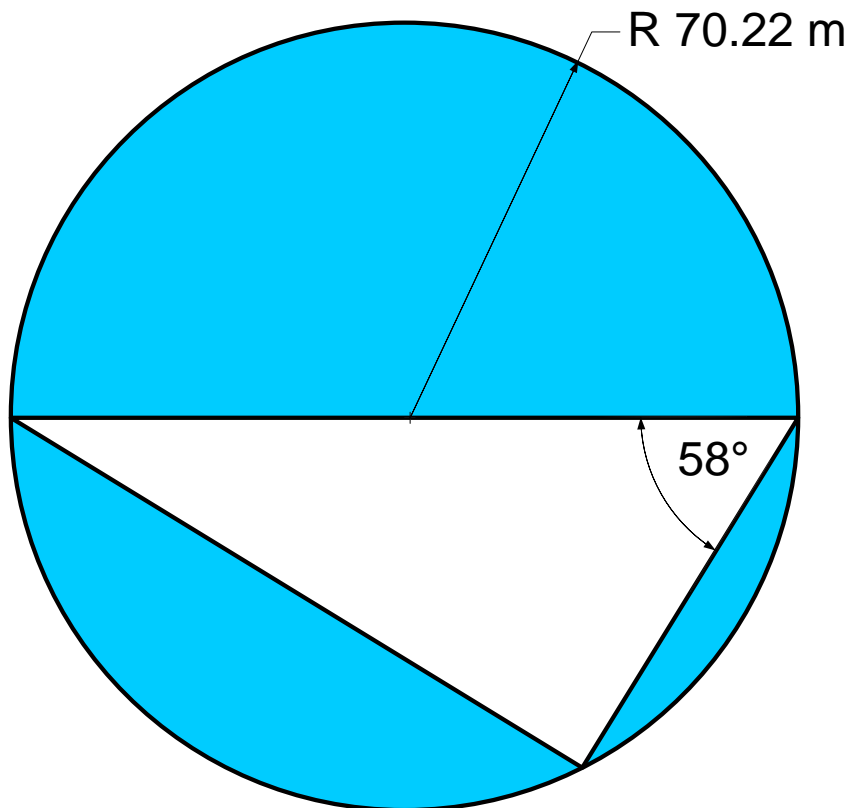


$$\angle ckl = 135^\circ$$

In the above diagram, ef is parallel to gj. Line ih is perpendicular to cd. Line cd is parallel to ab.

Your task is to work out the size of each of the angles in this diagram.

Shape: Part B. (Hint: Some officers have, curly auburn hair, til old age.)



Calculate the area of the circle outside the triangle: take π as 3.142.

| Angle | Sin | Cos | Tan |
|-------|----------|----------|----------|
| 1 | 0.841471 | 0.540302 | 1.557408 |
| 2 | 0.909297 | -0.41615 | -2.18504 |
| 3 | 0.14112 | -0.98999 | -0.14255 |
| 4 | -0.7568 | -0.65364 | 1.157821 |
| 5 | -0.95892 | 0.283662 | -3.38052 |
| 6 | -0.27942 | 0.96017 | -0.29101 |
| 7 | 0.656987 | 0.753902 | 0.871448 |
| 8 | 0.989358 | -0.1455 | -6.79971 |
| 9 | 0.412118 | -0.91113 | -0.45232 |
| 10 | -0.54402 | -0.83907 | 0.648361 |
| 11 | -0.99999 | 0.004426 | -225.951 |
| 12 | -0.53657 | 0.843854 | -0.63586 |
| 13 | 0.420167 | 0.907447 | 0.463021 |
| 14 | 0.990607 | 0.136737 | 7.244607 |
| 15 | 0.650288 | -0.75969 | -0.85599 |
| 16 | -0.2879 | -0.95766 | 0.300632 |
| 17 | -0.9614 | -0.27516 | 3.493916 |
| 18 | -0.75099 | 0.660317 | -1.13731 |
| 19 | 0.149877 | 0.988705 | 0.151589 |
| 20 | 0.912945 | 0.408082 | 2.237161 |
| 21 | 0.836656 | -0.54773 | -1.5275 |
| 22 | -0.00885 | -0.99996 | 0.008852 |
| 23 | -0.84622 | -0.53283 | 1.588153 |
| 24 | -0.90558 | 0.424179 | -2.1349 |
| 25 | -0.13235 | 0.991203 | -0.13353 |
| 26 | 0.762558 | 0.646919 | 1.178754 |
| 27 | 0.956376 | -0.29214 | -3.2737 |
| 28 | 0.270906 | -0.96261 | -0.28143 |
| 29 | -0.66363 | -0.74806 | 0.887143 |
| 30 | -0.98803 | 0.154251 | -6.40533 |

| Angle | Sin | Cos | Tan |
|-------|----------|----------|----------|
| 31 | -0.40404 | 0.914742 | -0.4417 |
| 32 | 0.551427 | 0.834223 | 0.661006 |
| 33 | 0.999912 | -0.01328 | -75.313 |
| 34 | 0.529083 | -0.84857 | -0.6235 |
| 35 | -0.42818 | -0.90369 | 0.473815 |
| 36 | -0.99178 | -0.12796 | 7.750471 |
| 37 | -0.64354 | 0.765414 | -0.84077 |
| 38 | 0.296369 | 0.955074 | 0.31031 |
| 39 | 0.963795 | 0.266643 | 3.614554 |
| 40 | 0.745113 | -0.66694 | -1.11721 |
| 41 | -0.15862 | -0.98734 | 0.160657 |
| 42 | -0.91652 | -0.39999 | 2.291388 |
| 43 | -0.83177 | 0.555113 | -1.49839 |
| 44 | 0.017702 | 0.999843 | 0.017705 |
| 45 | 0.850904 | 0.525322 | 1.619775 |
| 46 | 0.901788 | -0.43218 | -2.08661 |
| 47 | 0.123573 | -0.99234 | -0.12453 |
| 48 | -0.76825 | -0.64014 | 1.200127 |
| 49 | -0.95375 | 0.300593 | -3.17291 |
| 50 | -0.26237 | 0.964966 | -0.2719 |
| 51 | 0.670229 | 0.742154 | 0.903086 |
| 52 | 0.986628 | -0.16299 | -6.05327 |
| 53 | 0.395925 | -0.91828 | -0.43116 |
| 54 | -0.55879 | -0.82931 | 0.6738 |
| 55 | -0.99976 | 0.022127 | -45.1831 |
| 56 | -0.52155 | 0.85322 | -0.61127 |
| 57 | 0.436165 | 0.899867 | 0.484699 |
| 58 | 0.992873 | 0.11918 | 8.330857 |
| 59 | 0.636738 | -0.77108 | -0.82577 |
| 60 | -0.30481 | -0.95241 | 0.32004 |

| Angle | Sin | Cos | Tan |
|-------|----------|----------|----------|
| 61 | -0.96612 | -0.2581 | 3.743168 |
| 62 | -0.73918 | 0.673507 | -1.09751 |
| 63 | 0.167356 | 0.985897 | 0.16975 |
| 64 | 0.920026 | 0.391857 | 2.34786 |
| 65 | 0.826829 | -0.56245 | -1.47004 |
| 66 | -0.02655 | -0.99965 | 0.026561 |
| 67 | -0.85552 | -0.51777 | 1.652317 |
| 68 | -0.89793 | 0.440143 | -2.04008 |
| 69 | -0.11478 | 0.99339 | -0.11555 |
| 70 | 0.773891 | 0.633319 | 1.22196 |
| 71 | 0.951055 | -0.30902 | -3.07762 |
| 72 | 0.253823 | -0.96725 | -0.26242 |
| 73 | -0.67677 | -0.73619 | 0.919286 |
| 74 | -0.98515 | 0.171717 | -5.73702 |
| 75 | -0.38778 | 0.921751 | -0.4207 |
| 76 | 0.566108 | 0.824331 | 0.686748 |
| 77 | 0.99952 | -0.03098 | -32.2686 |
| 78 | 0.513978 | -0.8578 | -0.59918 |
| 79 | -0.44411 | -0.89597 | 0.495678 |
| 80 | -0.99389 | -0.11039 | 9.003655 |
| 81 | -0.62989 | 0.776686 | -0.81099 |
| 82 | 0.313229 | 0.949678 | 0.329826 |
| 83 | 0.968364 | 0.24954 | 3.880596 |
| 84 | 0.73319 | -0.68002 | -1.07818 |
| 85 | -0.17608 | -0.98438 | 0.17887 |
| 86 | -0.92346 | -0.3837 | 2.40673 |
| 87 | -0.82182 | 0.56975 | -1.44242 |
| 88 | 0.035398 | 0.999373 | 0.035421 |
| 89 | 0.860069 | 0.510177 | 1.685825 |
| 90 | 0.893997 | -0.44807 | -1.9952 |

| Fish Type | Cost |
|------------|--------|
| Goldfish | £2.94 |
| Clown fish | £6.75 |
| Koi Carp | £12.68 |
| Ghost Carp | £11.50 |

You have a budget of £100.

Can you spend exactly £100 on fish? If not, what is the closest amount you can get to the £100 spend? Remember that you must keep under £100 if you can't spend exactly £100.

You resell each fish making a profit that is proportional to the original amount that each fish costs. The profit is calculated as half the cost in percentage terms. ie for the Ghost Carp, the cost of the fish is 11.50 so the profit percentage is 5.75 %.

To calculate the resell price of the fish, you have to add the profit to the original cost. This can be done by:

$$\text{Cost of fish} + 5.75\% = 105.75\% \text{ of cost of fish.}$$

$$\frac{105.75}{100} \times \text{cost of fish} = \frac{105.75}{100} \times 11.50 \sim \text{£}12.16$$

This would yield a profit of £12.16 - £11.50 = £0.66

What are the profits for the other fish?

What is the most money you could make profit by selling different amounts of fish?