Part A

1. The value of $987+113-1000$ is
(**A**) 90 (**B**) 10 (**C**) 110 (**D**) 2000 (**E**) 100

Solution
$987+113=1100$
$1100-1000=100$

ANSWER: (E)

2. As a decimal, $\frac{9}{10}+\frac{8}{100}$ is
(**A**) 1.098 (**B**) 0.98 (**C**) 0.098 (**D**) 0.0908 (**E**) 9.8

Solution
Since $\frac{9}{10}=0.9$ and $\frac{8}{100}=0.08$, when we add we get $0.9+0.08=0.98$. ANSWER: (B)

3. What integer is closest in value to $7\times\frac{3}{4}$?
(**A**) 21 (**B**) 9 (**C**) 6 (**D**) 5 (**E**) 1

Solution
$7\times\frac{3}{4}=\frac{21}{4}=5\frac{1}{4}$. The integer closest to $5\frac{1}{4}$ is 5. ANSWER: (D)

4. The value of the expression $5^2-4^2+3^2$ is
(**A**) 20 (**B**) 18 (**C**) 21 (**D**) 10 (**E**) 16

Solution
$5^2=25,\ 4^2=16,\ 3^2=9$
Thus, $5^2-4^2+3^2=25-16+9=18$. ANSWER: (B)

5. When a number is divided by 7, it gives a quotient of 4 with a remainder of 6. What is the number?
(**A**) 17 (**B**) 168 (**C**) 34 (**D**) 31 (**E**) 46

Solution
The required number is $4\times7+6=34$. It is easy to verify this by dividing 34 by 7 which gives a quotient of 4 with remainder 6. ANSWER: (C)

6. In the addition shown, a digit, either the same or different, can be placed in each of the two boxes. What is the sum of the two missing digits?

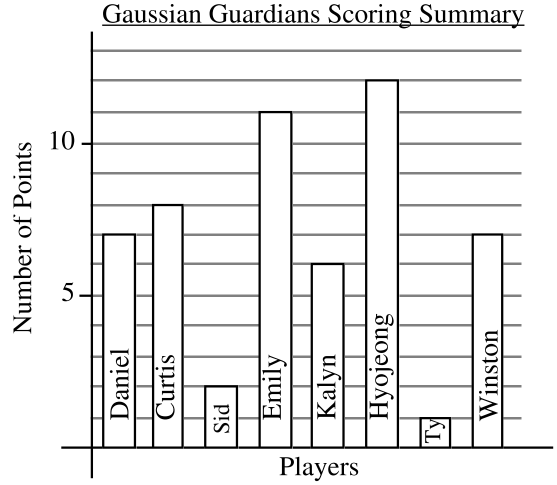
$$\begin{array}{r} 8\,6\,3 \\ \square\,9\,1 \\ 7\,\square\,8 \\ \hline 2\,1\,8\,2 \end{array}$$

(**A**) 9 (**B**) 11 (**C**) 13
(**D**) 3 (**E**) 7

Solution
Adding in the units column gives us, $3+1+8=12$. This means a carry over of 1 into the tens column since $12=1\times10+2$. In the tens column, we have 1 (carried over) $+6+9+\square=18$. The digit that is placed in this box is 2 with a carry over of 1 unit into the hundreds column. Moving to the hundreds column we have, 1 (carried over) $+8+\square+7=21$. The missing digit here is 5. The two missing digits are 2 and 5 giving a sum of 7. ANSWER: (E)

7. The graph shows the complete scoring summary for the last game played by the eight players on Gaussian Guardians intramural basketball team. The total number of points scored by the Gaussian Guardians was

Gaussian Guardians Scoring Summary



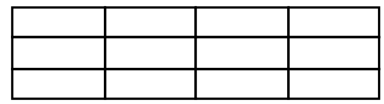
(**A**) 54 (**B**) 8 (**C**) 12
(**D**) 58 (**E**) 46

Solution
If we list all the players with their points, we would have the following: Daniel (7), Curtis (8), Sid (2), Emily (11), Kalyn (6), Hyojeong (12), Ty (1) and Winston (7).
The total is, $7+8+2+11+6+12+1+7=54$. ANSWER: (A)

8. If $\frac{1}{2}$ of the number represented by x is 32, what is $2x$?
(**A**) 128 (**B**) 64 (**C**) 32 (**D**) 256 (**E**) 16

Solution
If $\frac{1}{2}$ of the number represented by x is 32, then the number x is $2(32)$ or 64 and $2x$ is $2(64)$ or 128.
ANSWER: (A)

9. In the given diagram, all 12 of the small rectangles are the same size. Your task is to completely shade some of the rectangles until $\frac{2}{3}$ of $\frac{3}{4}$ of the diagram is shaded. The number of rectangles you need to shade is



(**A**) 9 (**B**) 3 (**C**) 4
(**D**) 6 (**E**) 8

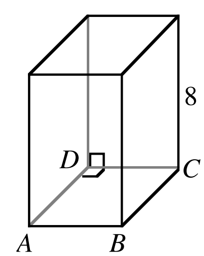
Solution
Since $\frac{2}{3} \times \frac{3}{4} = \frac{6}{12} = \frac{1}{2}$, the number of shaded rectangles is $\frac{1}{2} \times 12 = 6$. Answer: (D)

10. The sum of three consecutive integers is 90. What is the largest of the three integers?
(**A**) 28 (**B**) 29 (**C**) 31 (**D**) 32 (**E**) 21

Solution
Since the integers are consecutive, the middle integer is the average of the three integers. The middle integer is $\frac{90}{3} = 30$. The integers are 29, 30 and 31. The largest is 31. Answer: (C)

Part B

11. A rectangular building block has a square base *ABCD* as shown. Its height is 8 units. If the block has a volume of 288 cubic units, what is the side length of the base?



(**A**) 6 (**B**) 8 (**C**) 36
(**D**) 10 (**E**) 12

Solution
Since the volume of the rectangular block is 288 cubic units and volume is determined by: (Area of base)(Height), then the area of the base is $\frac{288}{8} = 36$. Since we have a square base, it must measure 6×6. The side length of the base is 6 units. Answer: (A)

12. A recipe requires 25 mL of butter to be used along with 125 mL of sugar. If 1000 mL of sugar is used, how much butter would be required?
(**A**) 100 mL (**B**) 500 mL (**C**) 200 mL (**D**) 3 litres (**E**) 400 mL

Solution
If 1000 mL of sugar is used, eight times as much sugar would be used as is required by the recipe. We would use 8×25 or 200 mL of butter. Answer: (C)

13. Karl had his salary reduced by 10%. He was later promoted and his salary was increased by 10%. If his original salary was \$20 000, what is his present salary?
(**A**) \$16 200 (**B**) \$19 800 (**C**) \$20 000 (**D**) \$20 500 (**E**) \$24 000

Solution
If Karl had his salary reduced by 10%, his new salary was $(0.90)(20\,000) = 18\,000$. If his salary was then increased by 10% his new salary is $(1.10)(18\,000) = 19\,800$. His salary after his 'promotion' is \$19 800.
ANSWER: (B)

14. The area of a rectangle is 12 square metres. The lengths of the sides, in metres, are whole numbers. The greatest possible perimeter (in metres) is
(**A**) 14 (**B**) 16 (**C**) 12 (**D**) 24 (**E**) 26

Solution
If the rectangle has an area of 12 square metres and its sides are whole numbers then we have only the following possibilities for the width (w), length (l) and corresponding perimeter:

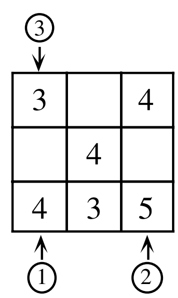
w	l	perimeter
1	12	26
2	6	16
3	4	14

The greatest possible perimeter is 26 m.
ANSWER: (E)

15. In the diagram, all rows, columns and diagonals have the sum 12. What is the sum of the four corner numbers?
(**A**) 14 (**B**) 15 (**C**) 16
(**D**) 17 (**E**) 12

		4
	4	
	3	

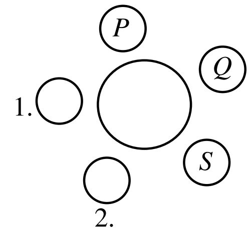
Solution
If we fill in the four corners in the indicated order the sum of the numbers at the corners is $4+3+4+5=16$. (This is, of course, not the only way to find the desired number. We could also have started by adding up along the centre column.)



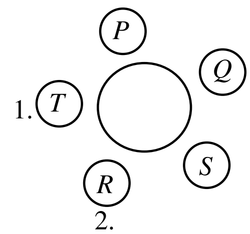
ANSWER: (C)

16. Paul, Quincy, Rochelle, Surinder, and Tony are sitting around a table. Quincy sits in the chair between Paul and Surinder. Tony is not beside Surinder. Who is sitting on either side of Tony?
(**A**) Paul and Rochelle (**B**) Quincy and Rochelle (**C**) Paul and Quincy
(**D**) Surinder and Quincy (**E**) Not possible to tell

Solution
If Quincy sits in the chair between Paul and Surinder then these three people would be seated as shown.



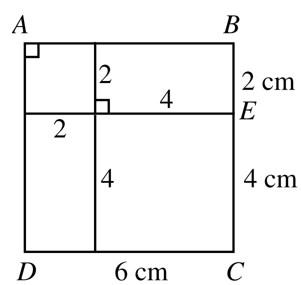
Since Tony does not sit beside Surinder then he must sit in the position labelled 1, and Rochelle must sit in the position labelled 2.



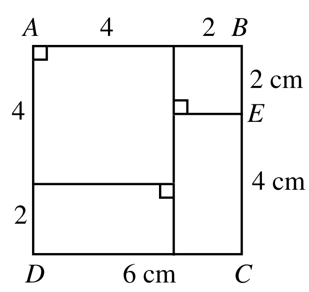
Thus, Tony is seated between Paul and Rochelle as shown in the diagram. ANSWER: (A)

17. $ABCD$ is a square that is made up of two identical rectangles and two squares of area 4 cm^2 and 16 cm^2. What is the area, in cm^2, of the square $ABCD$?
(**A**) 64 (**B**) 49 (**C**) 25 (**D**) 36 (**E**) 20

Solution
One way to draw the required square is shown in the diagram. The smaller square has a side length of 2 cm and the larger a side length of 4 cm. This gives the side length of the larger square to be 6 cm and an area of 36 cm^2.



Note that it is also possible to divide the square up as follows:

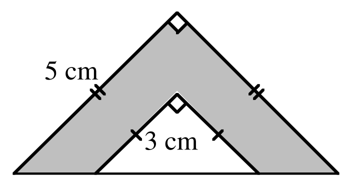


ANSWER: (D)

18. The month of April, 2000, had five Sundays. Three of them fall on even numbered days. The eighth day of this month is a
(**A**) Saturday (**B**) Sunday (**C**) Monday (**D**) Tuesday (**E**) Friday

Solution
Since three of the Sundays fall on even numbered days and two on odd numbered days this implies that the first Sunday of the month must fall on an even numbered day. Note that it is not possible for a Sunday to fall on the 4th day of the month because the 5th Sunday would then have to fall on the 32nd day of the month. The five Sundays will fall on the following days of the calendar: 2, 9, 16, 23, 30. April 8 must be a Saturday. ANSWER: (A)

19. The diagram shows two isosceles right-triangles with sides as marked. What is the area of the shaded region?
(**A**) 4.5 cm^2 (**B**) 8 cm^2 (**C**) 12.5 cm^2
(**D**) 16 cm^2 (**E**) 17 cm^2



Solution
The area of the larger triangle is $\frac{1}{2}(5)(5)$.

The area of the smaller triangle is $\frac{1}{2}(3)(3)$.

The shaded area is, $\frac{1}{2}(5)(5) - \frac{1}{2}(3)(3)$

$= \frac{1}{2}(25 - 9)$

$= 8.$

Thus the required area is 8 cm^2. ANSWER: (B)

20. A dishonest butcher priced his meat so that meat advertised at \$3.79 per kg was actually sold for \$4.00 per kg. He sold 1 800 kg of meat before being caught and fined \$500. By how much was he ahead or behind where he would have been had he not cheated?
(**A**) \$478 loss (**B**) \$122 loss (**C**) Breaks even (**D**) \$122 gain (**E**) \$478 gain

Solution
The butcher gained \$0.21 on each kg he sold and thus he dishonestly made $(0.21)(1800) = \$378.00$. After paying the \$500 fine, he would have a loss of $\$500 - \$378 = \$122$. ANSWER: (B)

Part C

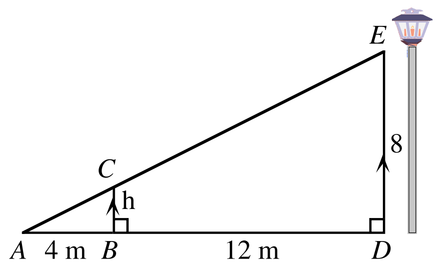
21. In a basketball shooting competition, each competitor shoots ten balls which are numbered from 1 to 10. The number of points earned for each successful shot is equal to the number on the ball. If a competitor misses exactly two shots, which one of the following scores is not possible?
(**A**) 52 (**B**) 44 (**C**) 41 (**D**) 38 (**E**) 35

Solution
If all ten balls scored, a score of 55 is possible.
If ball 1 and 2 is missed the maximum possible score is 52. Similarly, if 9 and 10 are missed, the minimum score is 36. Every score between 36 and 52 is also possible. Of the listed scores, 35 is the only score that is not possible. ANSWER: (E)

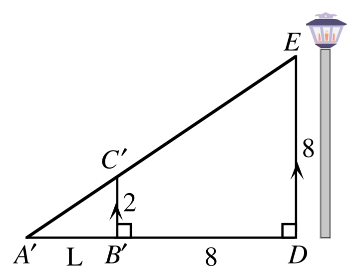
22. Sam is walking in a straight line towards a lamp post which is 8 m high. When he is 12 m away from the lamp post, his shadow is 4 m in length. When he is 8 m from the lamp post, what is the length of his shadow?

(**A**) $1\frac{1}{2}$ m (**B**) 2 m (**C**) $2\frac{1}{2}$ m (**D**) $2\frac{2}{3}$ m (**E**) 3 m

Solution
As Sam approaches the lamp post, we can visualize his position, as shown.
Since ΔABC and ΔADE are similar, the lengths of their corresponding sides are proportional. To determine Sam's height h, we solve $\frac{h}{4} = \frac{8}{16}$, and therefore h = 2 m.



As Sam moves to a position that is 8 m from the lamp post we now have the situation, as shown.
Using similar triangles as before, we can now calculate, L, the length of the shadow.



Thus, $\frac{L}{2} = \frac{L+8}{8}$.
Using the property of equivalent fractions, $\frac{L}{2} = \frac{4L}{8} = \frac{L+8}{8}$.
Thus, $4L = L + 8$
$3L = 8$
$L = 2\frac{2}{3}$ m

ANSWER: (D)

23. The total area of a set of different squares, arranged from smallest to largest, is 35 km^2. The smallest square has a side length of 500 m. The next larger square has a side length of 1000 m. In the same way, each successive square has its side length increased by 500 m. What is the total number of squares?

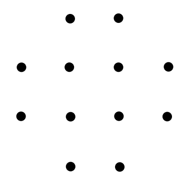
(**A**) 5 (**B**) 6 (**C**) 7 (**D**) 8 (**E**) 9

Solution
We complete the following chart, one row at a time, until 35 appears in the third column.

Number of the square	Length of the square	Area of the square	Cumulative sum of areas
1	0.5 km	0.25 km^2	0.25 km^2
2	1.0 km	1.00 km^2	1.25 km^2
3	1.5 km	2.25 km^2	3.50 km^2
4	2.0 km	4.00 km^2	7.50 km^2
5	2.5 km	6.25 km^2	13.75 km^2
6	3.0 km	9.00 km^2	22.75 km^2
7	3.5 km	12.25 km^2	35.00 km^2

Since there are seven rows, we conclude that there are seven squares. ANSWER: (C)

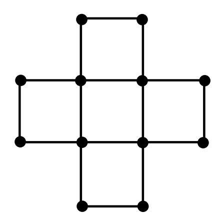
24. Twelve points are marked on a rectangular grid, as shown. How many squares can be formed by joining four of these points?



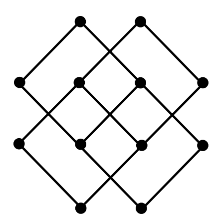
(**A**) 6 (**B**) 7 (**C**) 9
(**D**) 11 (**E**) 13

Solution
In total there are 11 possible squares as shown.

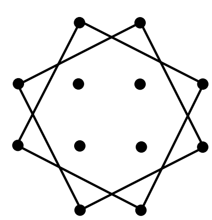
5 small squares:



4 large squares:

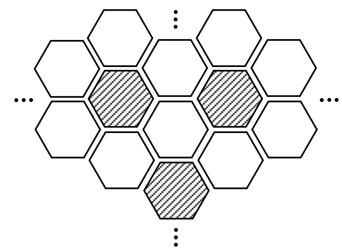


2 that are larger yet:



ANSWER: (D)

25. A square floor is tiled, as partially shown, with a large number of regular hexagonal tiles. The tiles are coloured blue or white. Each blue tile is surrounded by 6 white tiles and each white tile is surrounded by 3 white and 3 blue tiles. Ignoring part tiles, the ratio of the number of blue tiles to the number of white tiles is closest to



(**A**) 1:6 (**B**) 2:3 (**C**) 3:10
(**D**) 1:4 (**E**) 1:2

Solution
Let's start by considering seven tile configurations made up of one blue tile surrounded by six white tiles. If we look just at this tiling only in this way, it appears that there are six times as many white tiles as blue tiles. However, each white tile is adjacent to three different blue tiles. This means that every white tile is part of three different seven tile configurations. Thus, if we count white tiles as simply six times the number counted we will miss the fact that each white tile has been triple counted. Hence the number of white tiles is six times the number of blue tiles divided by three, or twice the number of blue tiles. The ratio of the number of blue tiles to the number of white tiles is 1:2.

ANSWER: (E)

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