SAT Math Level 1

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(1) Find the value of the following :

$17 \times 4 \times (-19) + 9 \times 13 =$ ______

(2) If  +  +  +  +  +  = 4, find the fractional value of .

(3) The nth term of an arithmetic progression is given by the equation $\boldsymbol{3 + 6n}$. What is the sum of the first 30 terms of this AP?

(4) What is the units digit in $(254)^{120} + (254)^{127}$?

(5) In a T20 cricket match, the first team has made 135 runs. If the second team has made 60 runs, what is the ratio of the runs they have scored to the runs they need to score more to win the match?

(6) In a right angled triangle, one of the other two angles is $60°$. What is the value of the remaining angle?

(7) What percentage of the following letters can be drawn using straight lines ?
F H V W B C U

(8) A line passes through the points (4, 5) and (1, 2). Find the y-intercept of the line.

(9) Calculate the median for the following data:

Marks obtained	Number of students
Less than 10	25
Less than 20	39
Less than 30	58
Less than 40	86
Less than 50	112
Less than 60	135
Less than 70	150
Less than 80	168

(10) Find the percentage increase in the area of a triangle if each side is increased to 6 times.

(11) Two circles with radii of 6 and 11 are drawn with the same center. The smaller inner circle is painted black, and the part outside the smaller circle and inside the larger circle is painted yellow. What is the ratio of the areas painted yellow to the area painted black?

a. 43:18
b. 85:36
c. 85:37
d. 86:37

(12) The diagonal of a rectangle is twice the length of its smaller side. What is the ratio of its length and breadth?

a. $2\sqrt{2}:1$
b. 2:1
c. $\sqrt{3}:1$
d. $\sqrt{15}:1$

(13) The positive solutions of the equation $p\mathbf{x} + q\mathbf{y} = r$ always lie in which quadrant?

(14) Two circles of radii 5 cm and 4 cm intersect at two points and the distance between their centres is 3 cm. Find the length of the common chord.

(15) The sides of a quadrilateral, taken in order are 13 cm, 10 cm, 12 cm and 5 cm respectively. The angle contained by the last two sides is a right angle. Find the area of the quadrilateral.

a. 90 cm^2 **b.** 60 cm^2

c. 180 cm^2 **d.** 135 cm^2

Answers

(1) -1175

Step 1

We can multiply the two numbers by using the following steps:
1. Firstly, we will multiply the mathematical signs of the numbers. We place a negative sign before the negative numbers and leave the positive numbers without any sign.
We can multiply the signs as shown below :
+ × **+** = **+**
+ × **−** = **−**
− × **−** = **+**
2. Now, we have to multiply the numbers.
For example :
3 × 2 = 6,
3 × (-2) = (-6),
(-3) × 2 = (-6),
(-3) × (-2) = 6

Step 2

Therefore, 17 × 4 × (-19) + 9 × 13 can be expressed as:
17 × 4 × (-19) + 9 × 13
= (-1292) + (117)
= -1175

Step 3

Hence, the value of 17 × 4 × (-19) + 9 × 13 is **-1175**.

(2) $\frac{4}{6}$

Step 1

According to the question, we have to find the addend that can replace .

We know that the sum of six similar addends is 4. So, we can write it as,

6 ×  = 4

Step 2

Thus, we can say, 3 ×  = 2

Therefore,  = 2 ÷ 3

$= \frac{4}{6}$

$= \frac{2}{3}$

Step 3

Hence, the fractional value of  is $\frac{4}{6}$.

(3) 2880

Step 1

According to the question, a_n = ***3 + 6n***

Therefore, $a_1 = 9$,

$a_2 = 15$,

$a_3 = 21$

Now, the required AP: 9, 15, 21 ....

$d = a_2 - a_1$

$= 15 - 9$

$= 6$

Step 2

The sum of the first 30 terms of this AP(S_{30}) = $\frac{30}{2}$ [2a + (30 - 1)d]

$\frac{30}{2}$ [(2 × 9) + (30 - 1)(6)]

= $\frac{30}{2}$ [(2 × 9) + (29) × (6)]

= 2880

Step 3

Thus, the sum of the first 30 terms of this AP is 2880.

(4) 0

Step 1

The units digit of both numbers is 4. Let's look at the pattern followed by the units digits of the higher powers of 4:

$4^1 = 4$

$4^2 = 16$

$4^3 = 64$

$4^4 = 256$

$4^5 = 1024$.

Step 2

We can see that for all the odd powers the units digit is 4 and for all even powers the units digit is 6.

Step 3

The given question has two terms. In the first term, the power of 254 is 120, which is an even number and in the second term the power is 127 which is an odd number. This means the units digit of the first term is 6 and that of the second term is 4. The sum of units digits = 6 + 4 = 10.

Step 4

This means the units digit of the given sum is **0.**

(5) 15:19

Step 1

Score made by the first team = 135 runs
Number of runs required to win the match = 135 + 1
Runs already scored by the second team = 60 runs
Therefore, the remaining runs to be scored to win the match = Winning score - Runs already scored
= (135 + 1) - 60
= 76

Step 2

Fraction of the runs they have made to the runs they need to win the match = $\frac{60}{76} = \frac{15}{19}$

Step 3

Thus, the ratio of the runs they have made to the runs they need to win the match is **15:19**.

(6) 30°

Step 1

In order to find the measure of the remaining angle, let us assume that its value is y.

Step 2

Since it is a right angled triangle, we have an angle of 90°. Also, one of the other two angles is 60°.

Step 3

Since the sum of all angles of a triangles is 180°, we can write:
$90° + 60° + y = 180°$
$150° + y = 180°$
$y = 180° - 150°$
$y = 30°$

Step 4

Hence, the value of the remaining angle is **30°**.

(7) 57.14

Step 1

F H V W B C U
On looking at the given letters carefully, we notice that the letters that can be drawn using straight lines are F H V W.

Step 2

So, the number of letters that can be drawn using straight lines = 4
Total number of letters = 7

Step 3

Now, the percentage of letters that can be drawn using straight lines =

$$\frac{\text{Letters that can be drawn using straight lines}}{\text{Total number of letters}} \times 100$$

$$= \frac{4}{7} \times 100$$

= **57.14%**.

(8) 1

Step 1

Equation of a line y = *m*x + *c*.

Step 2

Substitute first point in the equation:

5 = 4*m* + *c*

$\Rightarrow m = \frac{5 - c}{4}$ --------(1)

Step 3

Substitute second point in the equation:

2 = *m* + *c*

⇒ *m* = 2 - *c* --------(2)

Step 4

On equating value of *m* from both equations:

$\frac{5 - c}{4} = 2 - c$

⇒ 5 - *c* = 8 - 4*c*

⇒ 3*c* = 3

⇒ *c* = 1

Step 5

The y-intercept of the line is 1.

(9) 39.286

Step 1

The given data may be written as:

Marks obtained	Number of students
$0-10$	25
$10-20$	$39-25=14$
$20-30$	$58-39=19$
$30-40$	$86-58=28$
$40-50$	$112-86=26$
$50-60$	$135-112=23$
$60-70$	$150-135=15$
$70-80$	$168-150=18$

Step 2

Now, the data can be re-arranged as shown in following table,

Class	Frequency f_i	Cumulative Frequency cf
$0-10$	25	25

$10-20$	14	$25+14=39$
$20-30$	19	$39+19=58$
$30-40$	28	$58+28=86$
$40-50$	26	$86+26=112$
$50-60$	23	$112+23=135$
$60-70$	15	$135+15=150$
$70-80$	18	$150+18=168$
	$n=\sum f_i=168$	

From the above table we notice that,
$n=168$ and
$\frac{n}{2}=84.$
The Cumulative frequency just greater than or equal to the
$\frac{n}{2}$ is
86, belonging to the interval
$30-40.$
Therefore, the median class
$=30-40,$
Lower limit
(l) of the median class
$=30,$
Class size
$(h)=10,$
Frequency
(f) of the median class
$=28,$
Cumulative frequency
(cf) of the class preceding median class
$=58.$

Step 3

The median,
M_e

$$=l+\left\{h\times\frac{\left(\frac{n}{2}-cf\right)}{f}\right\}$$
$$=30+\left\{10\times\frac{(84-58)}{28}\right\}$$
$$=39.286$$

Step 4

Thus, the median of the data is
$39.286.$

(10) 3600 %

Step 1

Consider a triangle QRS with sides a, b and c. Let S = $\frac{a+b+c}{2}$

Area of triangle QRS, A_1 = $\sqrt{S(S-a)(S-b)(S-c)}$

Step 2

Increasing the side of each side by 6 times, we get a new triangle XYZ.
XYZ has sides 6a, 6b and 6c.
By Heron's formula,
Area of new triangle = $\sqrt{S_1(S_1-6a)(S_1-6b)(S_1-6c)}$

Where S_1 = $\frac{6a + 6b + 6c}{2}$ = 6 × $\frac{a+b+c}{2}$

Area of XYZ = $\sqrt{6S(6S-6a)(6S-6b)(6S-6c)}$ = $\sqrt{6^4 S(S-a)(S-b)(S-c)}$

= $6^2 \times A_1$

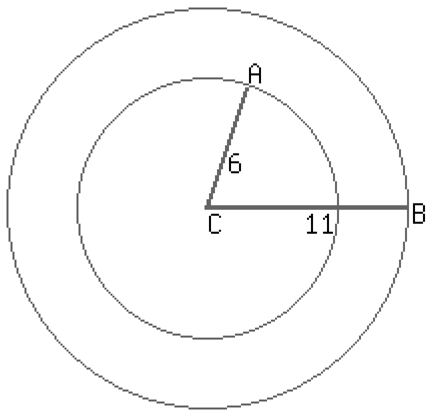
Step 3

This means the area, A_1 is increases by 6^2 times. or $6^2 \times 100 = 3600\%$

(11) b. 85:36

Step 1

Following figure shows the circles with radii 6 and 11 are drawn with the same center,



Step 2

We know that the area of a circle = $\pi(r)^2$

According to the question, the smaller inner circle is painted black, and the part outside the smaller circle and inside the larger circle is painted yellow.

The area painted black = The area of the smaller inner circle = $\pi(6)^2 = 36\pi$

Step 3

The area painted yellow = The area of the larger circle - The area of the smaller inner circle

$= \pi(11)^2 - \pi(6)^2$

$= \pi(11^2 - 6^2)$

$= \pi(121 - 36)$

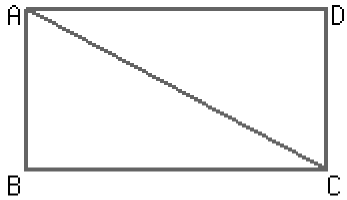
$= 85\pi$

Step 4

Thus, the ratio of the areas painted yellow to the area painted black = $\frac{85\pi}{36\pi} = \frac{85}{36}$ = **85:36**.

(12) c. $\sqrt{3}:1$

Step 1



Let us assume that ABCD is a rectangle.

Step 2

Let **b** and **l** be the breadth(smaller side) and length of the rectangle, respectively.
Since, the diagonal of the rectangle is twice the length of its smaller side.
Therefore, the length of the diagonal = **2b cm**.

Step 3

On looking at the rectangle ABCD carefully, we notice that ABC is a right angled triangle where AB, BC, and AC are the breadth, length, and diagonal of the rectangle, respectively.
Now, in the right angled triangle ABC,

$AC^2 = AB^2 + BC^2$

$\Rightarrow (2b)^2 = b^2 + l^2$

$\Rightarrow 4b^2 - b^2 = l^2$

$\Rightarrow (4 - 1)b^2 = l^2$

$\Rightarrow 3b^2 = l^2$

$\Rightarrow l^2 = 3b^2$

$\Rightarrow \frac{l^2}{b^2} = \frac{3}{1}$

$\Rightarrow (\frac{l}{b})^2 = \frac{3}{1}$

$\Rightarrow \frac{l}{b} = \frac{\sqrt{3}}{1}$

$\Rightarrow \mathbf{l:b = \sqrt{3}:1}$

Step 4

Therefore, we can say that the ratio of the length and breadth of the rectangle is $\mathbf{\sqrt{3}:1}$.

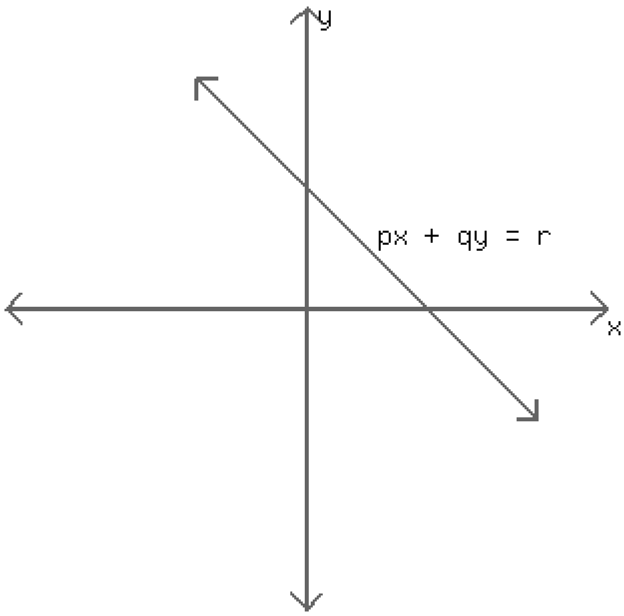
(13) First quadrant

Step 1

The solution of the pair of equations can be positive when x and y both are positive. This means, x>0 and y>0.

Step 2

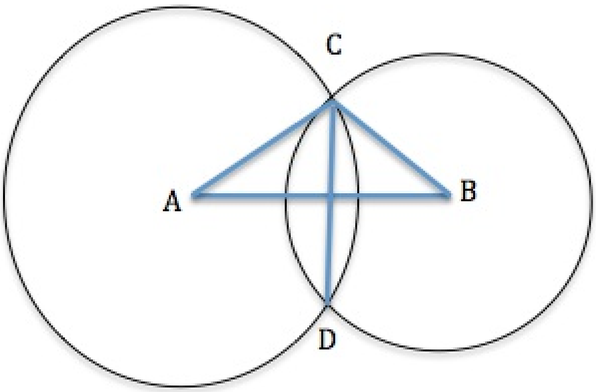
We know that a point (x, y) has both x and y greater than zero, it lies in the first quadrant. Hence, we can say that the positive solutions of the equation p**x** + q**y** = r always lie in first quadrant as shown below.



(14) 8 cm

Step 1

Take a look at the following image:



Here, A is the center of the first circle and B the center of the second circle. The common chord is CD.

Join AD and BD. Now, consider ∠ABC and ∠ABD. We have,

AC = AD (Radius of the circle with centre A)

BC = BD (Radius of the circle with centre B)
AB = AB (common)
Hence, ∠ABC ≅ ∠ABD by SSS.
So, ∠AOC = ∠AOD by CPCT. Also, AO = OB and CO = DO by CPCT.
Also, ∠AOC + ∠AOD = 180° (angles on a straight line)
⇒ ∠AOC + ∠AOC = 180°
⇒ 2 × ∠AOC = 180°
⇒ ∠AOC = 90°

Now, we know that the line AB bisects CD, and is perpendicular to it.
Also, the perpendicular from C to AB is half the length of CD. Let us call this length as L.

Area of ΔABC = $\frac{1}{2} \times AB \times L$

Step 2

By Heron's formula, area of ΔABC = $\sqrt{S(S-a)(S-b)(S-c)}$,

where, S = $\frac{AB + BC + CA}{2} = \frac{5 + 4 + 3}{2}$ = 6 cm

and *a,b,* and *c* are the length of three sides of the triangle. So, area of ΔABC = $\sqrt{6(6-5)(6-4)(6-3)}$ = 6 cm

Step 3

Area of ΔABC = 6 cm = $\frac{1}{2} \times AB \times L = \frac{1}{2} \times 3 \times L$

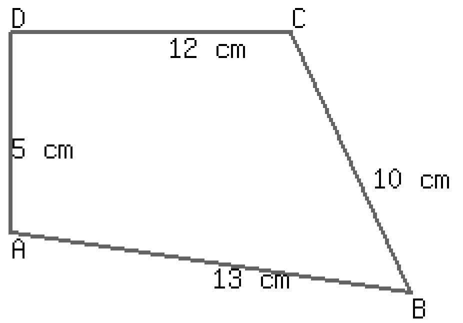
Therefore, L = $\frac{2 \times 6}{3}$ = 4 cm

Length of CD = 2L = 2 × 4 cm = **8 cm**

(15) **a.** 90 cm^2

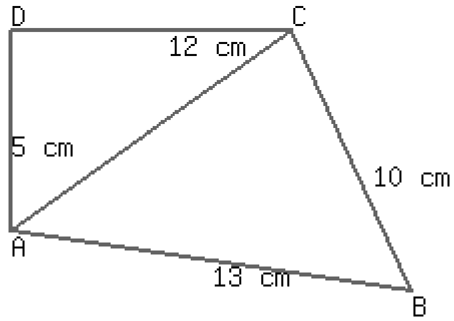
Step 1

Following picture shows the quadrilateral ABCD,



Step 2

Let's draw the line AC.



The ΔACD is the right angled triangle.

Therefore, $AC^2 = AD^2 + DC^2$

$\Rightarrow AC = \sqrt{[AD^2 + DC^2]}$

$= \sqrt{[5^2 + 12^2]}$

= 13 cm

Step 3

The area of the right angled triangle ΔACD = $\dfrac{AD \times DC}{2}$

$= \dfrac{5 \times 12}{2}$

$= 30\ cm^2$

Step 4

Now, we can see that, this quadrilateral consists of the triangles ΔACD and ΔABC.
The area of the ΔABC can be calculated using Heron's formula, since all sides of the triangle are known.
S = (AB + BC + CA)/2
= (13 + 10 + 13)/2
= 18 cm.
The area of the ΔABC = $\sqrt{[S (S - AB) (S - BC) (S - CA)]}$
$= \sqrt{[18(18 - 13) (18 - 10) (18 - 13)]}$
$= 60\ cm^2$

Step 5

The area of the quadrilateral ABCD = Area(ΔACD) + Area(ΔABC) = 30 + 60 = 90 cm^2