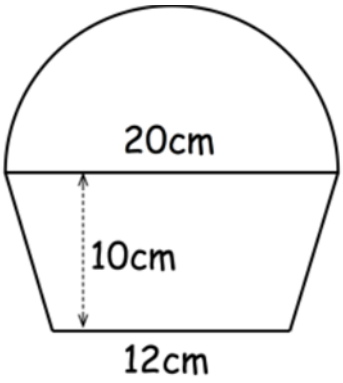
Round 1

Question 1



A design is made using a semi-circle and a trapezium. Find the area of this design. Give your answer in cm^2 to two decimal places

Solution

Area of trapezium

$$\left(\frac{20+12}{2}\right)(10)$$

$$160cm^2$$

Area of semi -circle

$$\frac{1}{2}\pi r^2$$

$$\frac{1}{2}\pi(10)^2$$

$$50\pi$$

Total area $160 + 50\pi$

$$317.0796327$$

$$317.08\ cm^2$$

Question 2

Factorise

$$x^2 - \frac{7}{6}x + \frac{1}{3}.$$

Solution

$$\left(x - \frac{2}{3}\right)\left(x - \frac{1}{2}\right)$$

Round 2

Question 1

Express c in terms of a, b and d.

Evaluate c , when $d = 5, a = 9$ and $b = 14$

$$d = \sqrt{\frac{a-b}{ac}}$$

Solution

$$d^2 = \frac{a-b}{ac}$$

$$d^2ac = a - b$$

$$c = \frac{a-b}{d^2a}$$

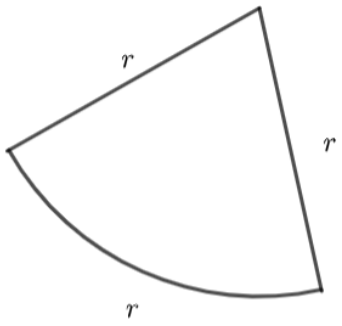
$$c = \frac{9-14}{(5)^2(9)} = \frac{-5}{225} = \frac{-1}{45}$$

Question 2

A sector has radius $r\ cm$, arc length $r\ cm$ and area $r\ cm^2$

Find the value of r.

$$r = 2cm$$



Solution

$\frac{\theta}{360}\ 2\pi r = r$ and $\frac{\theta}{360}\ \pi r^2 = r$

equate and $2r = r^2$ $r = 2\text{cm}$

Round 3

Question 1

Factorise:

$$27p^3q - 75pq$$

Solution

$$3pq(9p^2 - 25)$$

$$3pq((3p)^2 - (5)^2)$$

$$3pq(3p - 5)(3p + 5)$$

Question 2

The angles of a quadrilateral are in the ratio 3 : 4 : 5 : 6.

What is the difference between the largest angle and the smallest angle?

Solution

$$3 + 4 + 5 + 6 = 18$$

$$360° \div 18$$

$$20°$$

Largest angle $6(20) = 120°$

Smallest angle $3(20) = 60°$

The angles are $60°, 80°, 100°, 120°$

$$120° - 60° = 60°$$

Solution $60°$(degree symbol not required)

Round 4

Question 1

1. First we notice that there are 9 integers in each row, and the largest integer in each row is a multiple of 9. Since 2024÷9≈224.89, the largest integer in the row above 2024 will be 224×9=2016. So the integers in the row with 2024 will be 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, and 2025.

   Since 9 is an odd number, the multiples of 9 alternate between even and odd. Similarly, Dylan's rows of integers alternate directions. When the largest integer in a row is odd, the integers in that row are written from left to right, and when the largest integer in a row is even, the integers in that row are written from right to left. Since 2025 is odd, the integers in this row will be written from left to right. We can then count backwards to determine the integer directly above 2024, as shown.

2016	2015	2014	2013	2012	2011	2010	2009	2008
2017	2018	2019	2020	2021	2022	2023	2024	2025

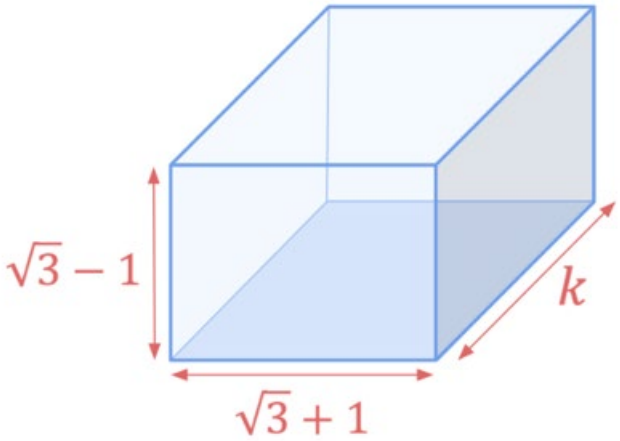
   Thus, the integer directly above 2024 is 2009.

   ANSWER: 2009

Question 2

The volume of a cuboid is $16cm^3$.

Calculate the value of k in cm.



Solution

$$k = 8cm$$

$$(\sqrt{3}-1)(\sqrt{3}+1)(k) = 16$$

$$2k = 16$$

$$k = 8cm$$

Round 5

Question 1

A train is 150 metres long and moving at a speed of 54 km/h. It takes 30 seconds to pass a platform. What is the length of the platform?

Solution

Train = 150m

Speed = 54km/hr $= \frac{54x1000}{60x60} = 15m/s$

Distance = Speed x Time

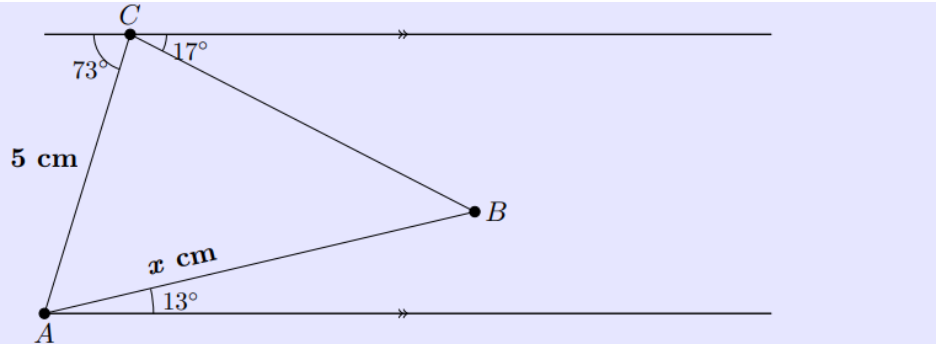
$$D = 15\ x\ 30seconds = 450m$$

But 450m is the length of the train and platform.

$$450 - 150 = 300m$$

Question 2

In the diagram, the triangle ABC lies between two parallel lines as shown below. If the line segment $[AC]$ is $5cm$ in length, calculate the length of the line segment $[AB]$.



Solution

$$x = 10cm$$

$$\angle C = 180° - 17° - 73°$$

$$\angle C = 90°$$

$$\angle A = 73° - 13° = 60° \text{ (alternate angles)}$$

$$Cos\ 60° = \frac{5}{x}$$

$$x = \frac{5}{Cos\ 60°}$$

$$x = 10cm$$

In the right triangle with angles 30,60,90, the hypotenuse is twice the side opposite to the 30 angle.

Round 6

Question 1

The total cost of one chocolate bar and two identical packs of mints is €4.15. One chocolate bar costs €1.00 more than one pack of mints. Calculate the cost of one chocolate bar.

Solution

$$Let\ x = chocolate\ bar\ and\ y = 1\ pack\ of\ mints$$

$$1x + 2y = 4.15$$

$$1x = 1 + 1y$$

$$1x + 2y = 4.15$$

$$\underline{x - y = 1}$$

$$3y = 3.15$$

$$y = 1.05$$

$$x = 2.05$$

Chocolate = €2.05

Question 2

Solve the equation $\frac{x-1}{3} - \frac{5x+2}{4} = 1.$

Solution

$$\frac{12(x-1)}{3} - \frac{12(5x+2)}{4} = 12(1)$$

$$4(x-1) - 3(5x+2) = 12$$

$$4x - 4 - 15x - 6 = 12$$

$$-11x - 10 = 12$$

$$-11x = 22$$

$$x = -2$$

Round 7

Question 1

$$9(2x + 5) + 2(3x + b) = ax + 23$$

Work out the values of a and b in the equation.

Solution

$18x + 45 + 6x + 2b = ax + 23$

$18x + 6x = 24x$

$a = 24$

$45 + 2b = 23$

$2b = 23 - 45$

$2b = -22$

$b = -11$

Answer $a = 24, b = -11$

Question 2

A point with coordinates $(a, 2a)$ lies in the 3rd quadrant and on the curve given by the equation $3x^2 + y^2 = 28$. Find a.

Solution

$3(a)^2 + (2a)^2 = 28$

$7a^2 = 28$

$a^2 = 4$

$a = \sqrt{4}$

$a = -2$ (as lies in Q3)

Question 3

John had a box of chocolates. On the first day he ate half of the chocolates and then gave one of the remaining chocolates to his little sister. On the second day he ate half of the chocolates and then gave one of the remaining chocolates to his little sister. On the third day he ate half of the chocolates and gave one to his little sister, at which point no chocolates remained. How many chocolates were in the box at the start?

Solution

Start with x chocolates

After day 1

$\frac{x}{2} - 1 = \frac{x-2}{2}$

After day 2

$\frac{\frac{x}{2}-1}{2}$ -1 $= \frac{\frac{x-2}{2}}{2}$-1

$$\frac{x-6}{8} - 1 = 0$$

$$x - 6 = 8$$

$$x = 14$$

Question 4

There are 26 dogs and n cats in a neighbourhood. If two pets from the neighbourhood are selected at random, the probability that both pets are cats is $\frac{1}{14}$. Calculate the total number of pets in the neighbourhood.

Solution

$P(C,C) = \frac{1}{14}$

$\frac{n}{n+26} \times \frac{n-1}{n+25} = \frac{1}{14}$

$14n(n-1) = (n+26)(n+25)$

$14n^2 - 14n = n^2 + 51n + 650$

$13n^2 - 65n - 650 = 0$

$n^2 - 5n - 50 = 0$

B) $n^2 - 5n - 50 = (n-10)(n+5)$

Hence there are 10 cats, 26 dogs and so a total of 36 pets.

Round 8

Question 1

A golfer hits 80 drives during a practice session. Out of these, 52 land in the fairway, 18 land in the rough, and the rest are lost. If the golfer improves their fairway accuracy by 25%, how many drives will land in the fairway out of the next 80 drives?

Solution

$\frac{52}{80} x\ 100 = 65\%\ x\ 1.25 = 81.25\%$

$$80\ x\ 81.25\% = 65\ drives$$

Question 2

The line passes through the points $P(2,3)$ and $Q(5,7)$ The line is translated 4 units to the left and 3 units up.

What is the equation of the new line?

Solution:

$$(2,3)\ \ (-4,3) \rightarrow\ \ (-2,6)$$

$$(5,7)\ \ (-4,3) \rightarrow\ \ (1,10)$$

$m = \frac{y2-y1}{x2-x1} = \frac{10-6}{1-(-2)} = \frac{4}{3}$

$$y - y1 = m(x - x1)$$

$$y - 6 = \frac{4}{3}(x - (-2))$$

$$3y - 18 = 4x + 8$$

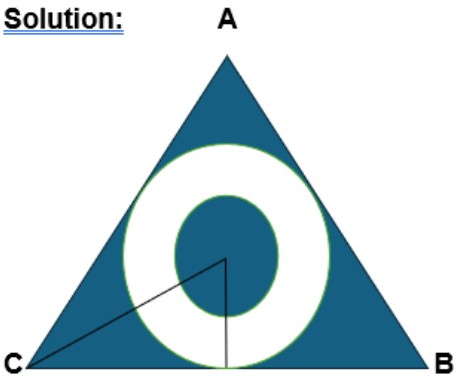
$$4x - 3y + 26 = 0$$

Question 3

In the equilateral triangle ABC, a circle is inscribed such that it touches all three sides of the triangle. The vertex A of the triangle corresponds to 12 o'clock on a clock face, vertex B corresponds to 4 o'clock, and vertex C corresponds to 8 o'clock. All sides are 10cm in length.

Calculate the radius of the inscribed circle, to 2 decimal places

Solution:



5cm

Angle ACB = 60 degrees

The line drawn from c to the centre creates an angle of 30 degrees.

To find from centre to base:

$$Tan\ 30 = \frac{r}{5}$$

$$5Tan30 = r$$

$$r = 2.89cm$$

Question 4

The weekly wages (in Euros) of 8 employees at a company are as follows:
450, 500, 550, 600, x, 480, 520, 550

If the mean weekly wage is 510 euros, what is the value of the median?

Solution:

$$\frac{450 + 500 + 550 + 600 + x + 480 + 520 + 550}{8} = 510$$

$$3650 + x = 510(8)$$

$$x = 4080 - 3650$$

$$x = 430$$

Median: $(430,450,480,500,520,550,550,600)$

$$\frac{500 + 520}{2} = 510$$