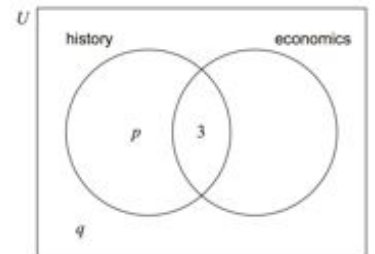


Math SL PROBLEM SET 25

Section A (Short Answer)

1. (CI) Consider $f(x) = x^2 + qx + r$. The graph of f has a minimum value when $x = -1.5$. The distance between the two zeroes of f is 9.
- Show that the two zeroes are 3 and -6.
 - Find the values of q and of r .

2. (CI) In a group of 20 girls, 13 take history and 8 take economics. Three girls take both history and economics, as shown in the following Venn diagram. The values of p and q represent numbers of girls.



- Find the value of:
 - p ;
 - q .
 - A girl is selected at random. Find the probability that she takes economics but not history.
 - A girl is selected at random. Find the probability that she studies economics given that she does not study history.
3. (CI) Consider the following sequence of figures.

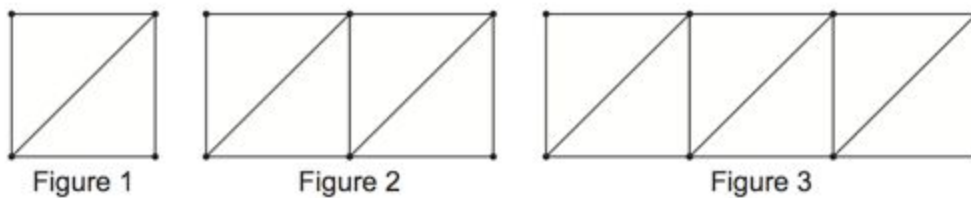
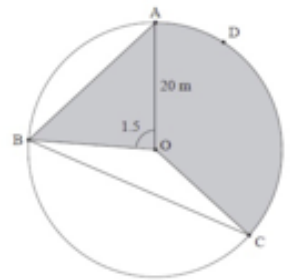


Figure 2 contains 9 line segments.

- How many line segments do Figure 1 and Figure 3 have?
- Given that Figure n contains 801 line segments, show that $n = 200$.
- Hence, or otherwise, find the total number of line segments in the first 200 figures.

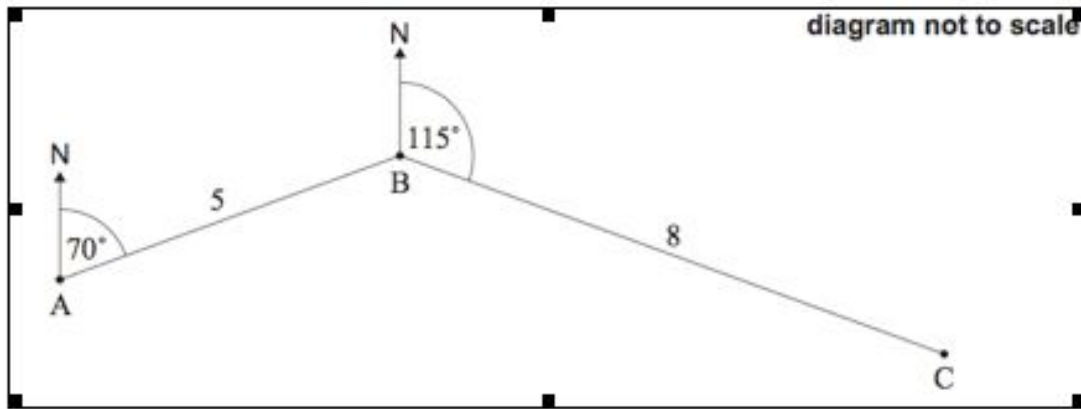
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4. (CI) Given the equation $2\cos^2(x) + \cos(x) = 0$, where $-\pi \leq x \leq 2\pi$;
- Factor the expression $2\cos^2(x) + \cos(x)$.
 - Hence or otherwise, solve $2\cos^2(x) + \cos(x) = 0$.
5. (CI) Given the function $h(x) = \log_3(x + 6)$, determine
- the equation of the vertical asymptote of $h(x)$.
 - the solution(s) to the equation $\log_3 x + \log_3(x + 6) = 3$
6. (CA) Consider the graph of $f(x) = \frac{e^x}{5x-10} + 3$, for $x \neq 2$.
- Find the x - and y -intercepts.
 - Find the equation(s) of the vertical and horizontal asymptotes.
 - Find the minimum value of $f(x)$ on the domain of $x > 2$.
7. (CA) Given the binomial expression $(3x + 2)^9$;
- Find the term in x^6 in the expansion of $(3x + 2)^9$.
 - Hence, find the term in x^7 in the expansion of $5x(3x + 2)^9$.
8. (CA) In a geometric sequence, the fourth term is 8 times the first term. The sum of the first 10 terms is 2557.5. Find the 10th term of the sequence.
9. (CA) The following diagram shows a circular play area for children. The circle has centre O and a radius of 20 m, and the points A, B, C and D lie on the circle. Angle AOB is 1.5 radians.
- Find the area of triangle AOB.
 - Angle BOC is 2.4 radians. Find the length of arc ADC.
 - The entire shaded area needs to be painted. Paint costs \$2.50 per square meter. Find the cost of painting the area of the shaded region.



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10. (CA) The following diagram shows three towns A, B and C. Town B is 5 km from Town A, on a bearing of 070° . Town C is 8 km from Town B, on a bearing of 115° .

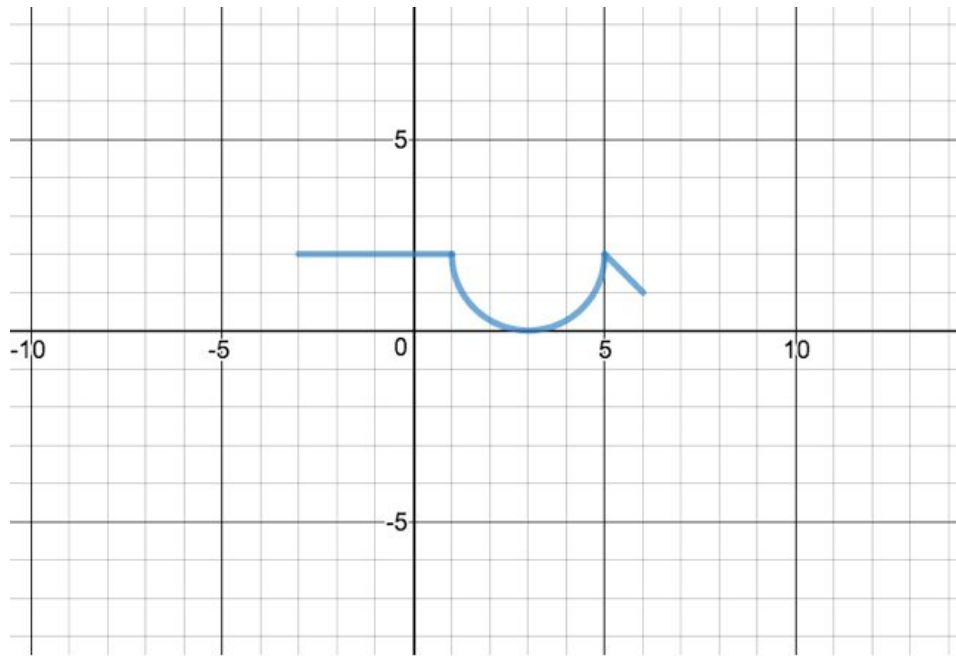


- Find the measure of $\angle ABC$.
- Find the distance from Town A to Town C.
- Use the sine rule to find $\angle ACB$.

SECTION B (Extended Response)

11. (CI) The graph shows the function $y = h(x)$, for $-3 \leq x \leq 6$.
- The function $h(x)$ is now transformed. Let $g(x) = 2 + h(-x)$. Sketch $g(x)$ on the graph.
 - A different transformation is now applied to the function $h(x)$. Let $f(x) = -h(x + 3) + 6$. The point $A(-3, 2)$ is on the graph of $h(x)$ but is now transformed to the new position, P , on the graph of $f(x)$. Find the co-ordinates of P .
 - A quadratic function is given where $Q(x) = (x - 4)(x + 2)$. Also, recall that the point A is on $h(x)$ such that $h(-3) = 2$.
 - Evaluate $(Q \circ h)(-3)$
 - Evaluate $(Q \circ h^{-1})(0)$

Math SL PROBLEM SET 25



12. (CI) A school collects cans for recycling to raise money. Sam's class has 20 students. The number of cans selected by each student in Sam's class is shown in the following stem and leaf diagram.

Stem	Leaf	Key: 3 1 represents 31 cans
2	0, 1, 4, 9, 9	
3	1, 7, 7, 7, 8, 8	
4	1, 2, 2, 3, 5, 6, 7, 8	
5	0	

- a. Find the median number of cans collected.

The following box-and-whisker plot also displays the number of cans collected by the students in Sam's class.



- b. (i) Write down the value of a .
(ii) The interquartile range is 14. Find the value of b .

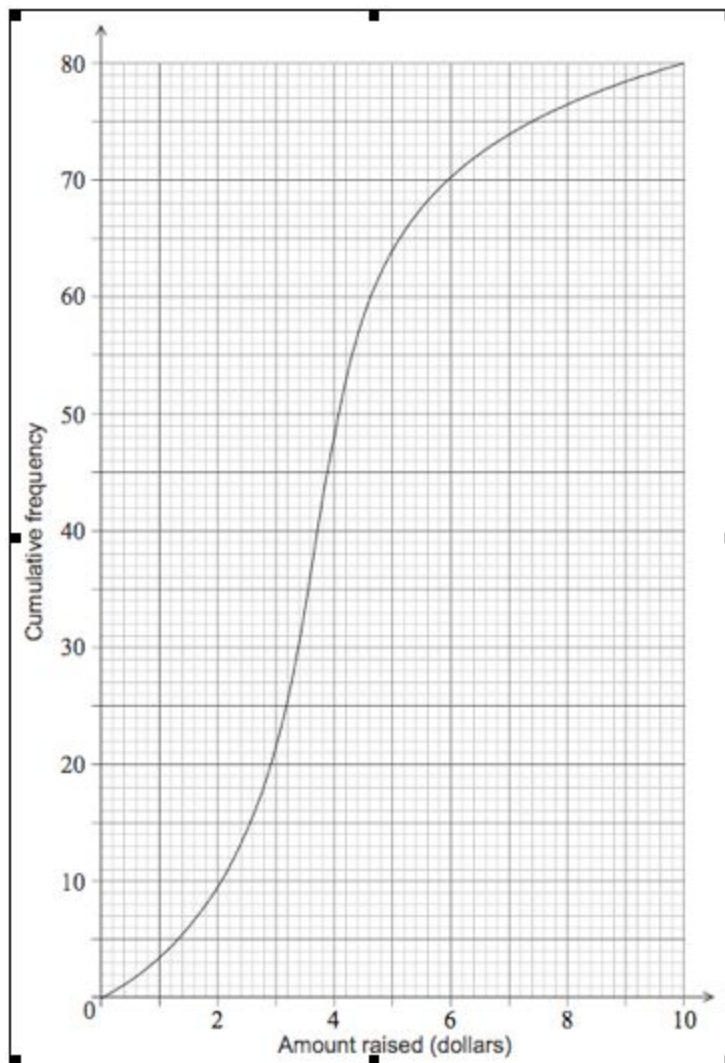
Math SL PROBLEM SET 25

- c. Sam's class collected 745 cans. They want an average of 40 cans per student. How many more cans do they need to achieve this target?

The following cumulative frequency curve included on the next page shows the amounts in dollars raised by all the students in Grade 11. There are 80 students in Grade 11.

The students earn \$0.10 for each recycled can.

- d. (i) Find the **greatest** amount of money raised by any student in Sam's class.
(ii) Find the percentage of students in Grade 11 who raised more money than anyone in Sam's class.

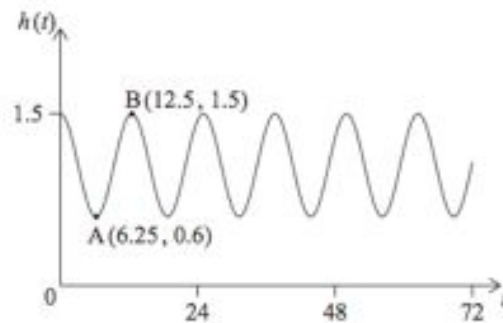


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The mean number of cans collected is 39.4 cans. The standard deviation is 18.5 cans. Each student now collects 2 more cans.

- e. (i) Write down the new mean number of cans collected.
(ii) Write down the new standard deviation of the number of cans selected.

13. (CA) At Grand Anse Beach, the height of the water in meters is modeled by the function , where t is the number of hours after 21:00 on the 10th of December 2017. The following diagram shows the graph of h , for $0 \leq t \leq 72$.



The point A(6.25, 0.6) represents the first low tide and B(12.5, 1.5) represents the next high tide.

- a. (i) How much time is there between the first low tide and the next high tide?
(ii) Find the difference in height between the low tide and the high tide.
- b. Find the value of:
- p ;
 - q ;
 - r .
- c. There are two high tides on 12 December 2017. At what time does the second high tide occur?

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14. (CA) Two position vectors are given as $OA = \left(\frac{1}{2}\right)$ and $OB = \left(\frac{6}{8}\right)$.
- Explain why the co-ordinates of point A are (1,2).
 - Draw both of these vectors as position vectors on the grid attached.
 - Draw vector on the grid and write in unit vector form.
 - Find the magnitude of vector AB .
 - Hence or otherwise, find the measure of the angle between OA and OB .