

Math SL PROBLEM SET 6

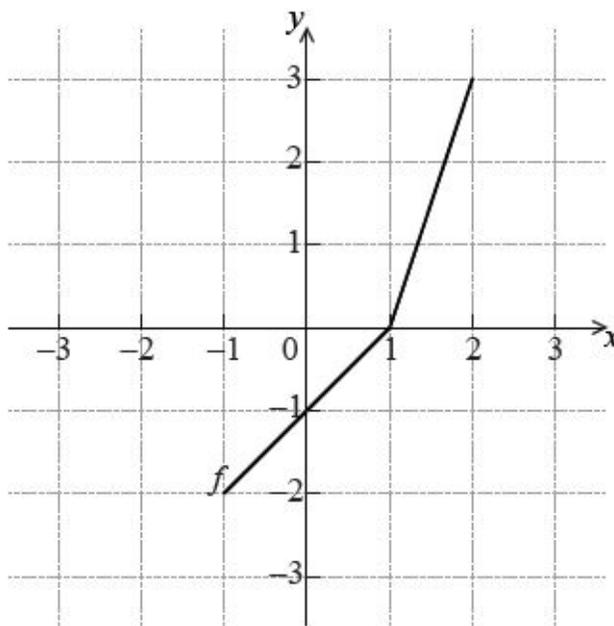
The major point to this PROBLEM SET is to get you set for Assessments in IB Math. We have selected a number of Section 1 questions (Short Answer questions) and Section 2 questions (Extended Response questions).

You will answer the questions INDIVIDUALLY and then you and your group will MARK your answers. I will give you the correct answers, but you & your group must decide HOW to distribute the marks.

Then, I will give you the “official” IB mark scheme, whereupon you will remark your solutions.

Section A (Short Answer)

- Let $f(x) = \sqrt{x - 5}$ for $x \geq 5$. ([Cirrito 5.4.1, p148](#); [Cirrito 5.4.2, p157](#))
 - Find $f^{-1}(2)$. [3 marks]
 - Let $g(x)$ be a function such that g^{-1} exists for all real numbers. Given that $g(30) = 3$, find $f \circ g^{-1}(3)$. [3 marks]
- The diagram below shows the graph of a function, f , for $-1 \leq x \leq 2$ ([Cirrito 6.1, p167](#); [Cirrito 6.2, p177](#); [Cirrito 6.3, p183](#))



- Write down the value of $f(2)$. [1 mark]
- Write down the value of $f^{-1}(-1)$. [2 marks]
- Sketch the graph of $f^{-1}(x)$ on the grid above. [3 marks]

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3. Let g be a quadratic function such that $g(0) = 5$. The line $x = 2$ is the axis of symmetry of the graph of g . *(Cirrito 2.4.2, p44)*

a. Find $g(4)$. [3 marks]

b. The function g can be expressed in the form $g(x) = a(x - h)^2 + 3$. [4 marks]

i. Write down the value of h .

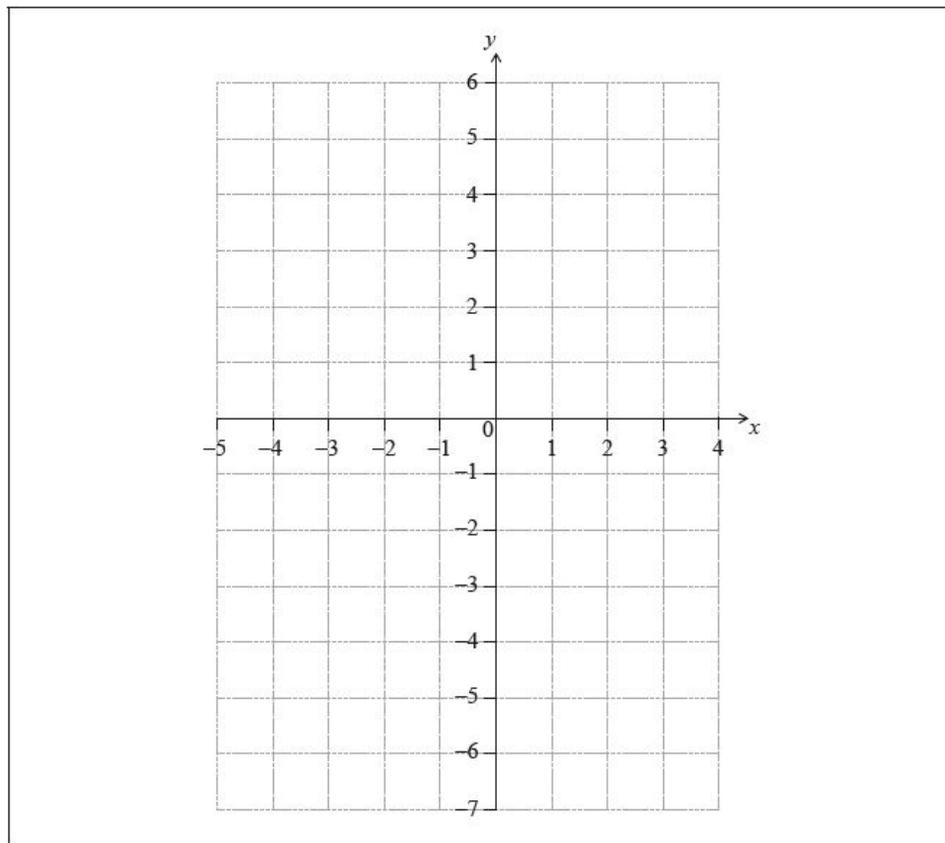
ii. Find the value of a .

4. Let $f(x) = x^2 + x - 6$. *(Cirrito 2.4.2, p44)*

a. Write down the y-intercept of the graph of f . [1 mark]

b. Solve $f(x) = 0$. [3 marks]

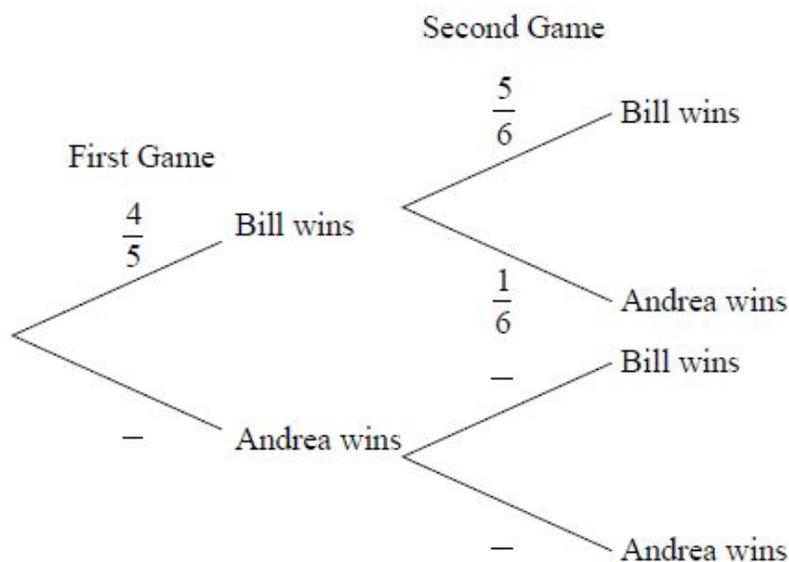
c. On the following grid, sketch the graph of f , for $-4 \leq x \leq 3$. [3 marks]



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5. Bill and Andrea play two games of tennis. The probability that Bill wins the first game is $\frac{4}{5}$. If Bill wins the first game, the probability that he wins the second game is $\frac{5}{6}$. If Bill loses the first game, the probability that he wins the second game is $\frac{2}{3}$. (Oxford 3.5, p89)

- Complete the following tree diagram. [3 marks]
- Find the probability that Bill wins the first game and Andrea wins the second game. [2 marks]
- Find the probability that Bill wins at least one game. [2 marks]



6. Let f and g be functions such that $g(x) = 2f(x + 1) + 5$. (Cirrito 6.1, p167; Cirrito 6.2, p177; Cirrito 6.3, p183)
- The graph of f is mapped to the graph of g under the following transformations:
vertical stretch by a factor of k , followed by a translation $\begin{pmatrix} p \\ q \end{pmatrix}$. Write down the value of [3 marks]
 - k ;
 - p ;
 - q .
 - Let $h(x) = -g(3x)$. The point $A(6, 5)$ on the graph of g is mapped to the point A' on the graph of h . Find A' . [3 marks]

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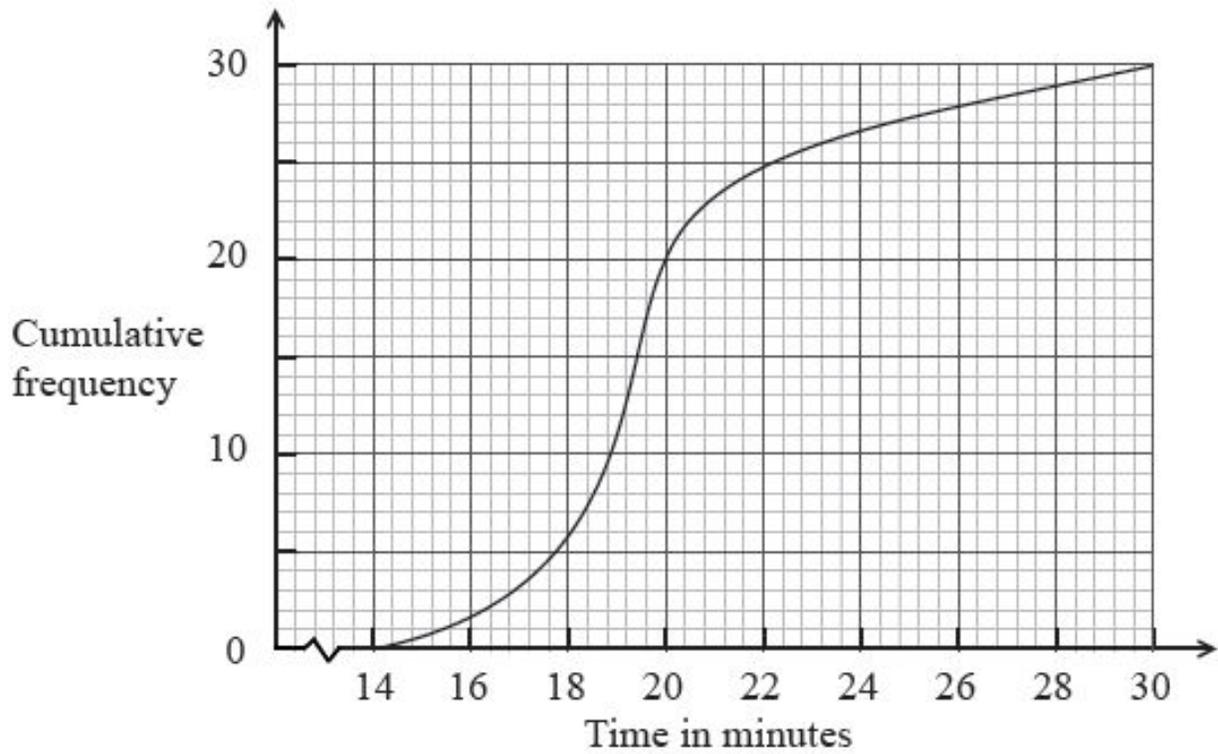
Section B (Extended Response)

7. A running club organizes a race to select girls to represent the club in a competition. The times taken by the group of girls to complete the race are shown in the table below
(Cirrito 15.1, p503; Cirrito 13.2, p471)

Time t minutes	$10 \leq t < 12$	$12 \leq t < 14$	$14 \leq t < 20$	$20 \leq t < 26$	$26 \leq t < 28$	$28 \leq t < 30$
Frequency	50	20	p	40	20	20
Cumulative Frequency	50	70	120	q	180	200

- a. Find the value of p and of q . [4 marks]
- b. A girl is chosen at random. [3 marks]
- Find the probability that the time she takes is less than 14 minutes.
 - Find the probability that the time she takes is at least 26 minutes.
- c. A girl is selected for the competition if she takes less than x minutes to complete the race. Given that 40% of the girls are not selected, [4 marks]
- find the number of girls who are not selected;
 - find x .
- d. Girls who are not selected, but took less than 25 minutes to complete the race, are allowed another chance to be selected. The new times taken by these girls are shown in the cumulative frequency diagram below. [4 marks]

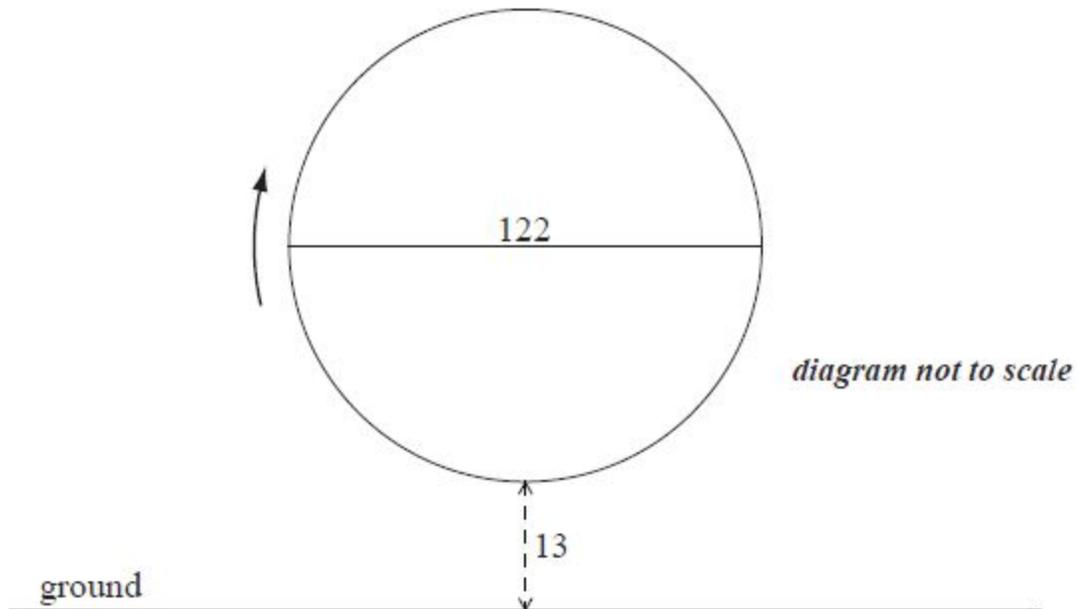
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- i. Write down the number of girls who were allowed another chance.
- ii. Find the percentage of the whole group who were selected.

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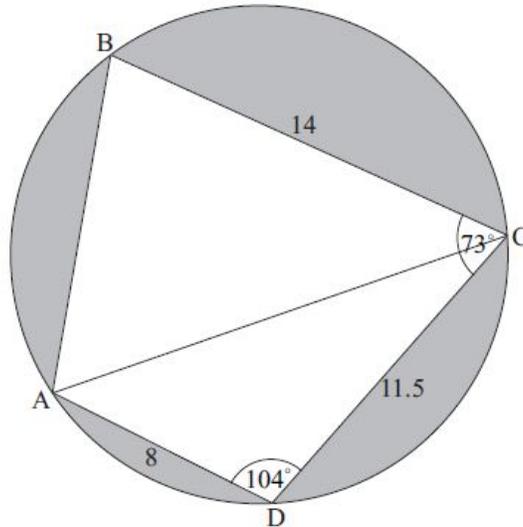
8. A Ferris wheel with diameter 122 metres rotates clockwise at a constant speed. The wheel completes 2.4 rotations every hour. The bottom of the wheel is 13 metres above the ground. *(Cirrito 10.5, p361)*



- A seat starts at the bottom of the wheel.
- Find the maximum height above the ground of the seat. [2 marks]
 - After t minutes, the height h metres above the ground of the seat is given by $h(t) = 74 + a \cos(bt)$. [2 marks]
 - Show that the period of $h(t)$ is 25 minutes.
 - Write down the **exact** value of b .
 - Find the value of a . [3 marks]
 - Sketch the graph of $h(t)$, for $0 \leq t \leq 50$. [4 marks]
 - In one rotation of the wheel, find the probability that a randomly selected seat is at least 105 metres above the ground. [5 marks]

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9. The diagram shows a circle of radius 8 metres. The points ABCD lie on the circumference of the circle. (*Cirrito 9.4, p 287; Cirrito 9.7, p309*)



$BC = 14$ m, $CD = 11.5$ m, $AD = 8$ m, angle $ADC = 104^\circ$, and angle $BCD = 73^\circ$

- Find AC. [3 marks]
- Find: [5 marks]
 - Find the measure of angle ACD.
 - Hence, find the measure of angle ACB.
- Find the area of triangle ADC. [2 marks]
- Hence or otherwise, find the total area of the shaded regions. [4 marks]