

Linear Equation and Mathematical Modeling

Class: _____ Group No.: _____ Name: _____

I. Review:

(i) Define the following mathematical terms in your own words and put **Chinese** translation in the box.

Terms	Symbol	Chinese translation	Terms	Symbol	Chinese translation
Linear equation	$2x+3y-7=$		Function		
Slope/Gradient			Arithmetic mean	$\frac{1}{3}(1+2+3) = 2$	
Coefficient	$ax+bx+c=0$		Piecewise function	$f(x) = \begin{cases} 2x+3 & x \leq 1 \\ 5 & x > 1 \end{cases}$	
Intercept					

(ii) Find the equation of the line by the given conditions.

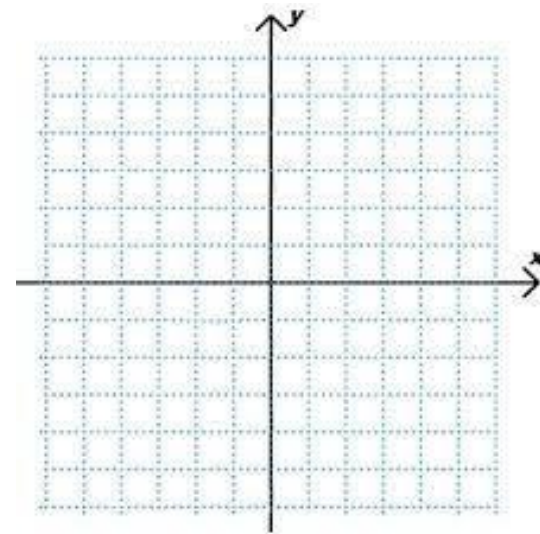
(a) a line has gradient 5 and passes through the point (2,7)

(b) a line has x -intercept 5 and y -intercept -2

(iii) Find the equation of the line that passes through the points (2,3) and (-4,-1).

Draw a line on the given Cartesian coordinates (坐標平面).

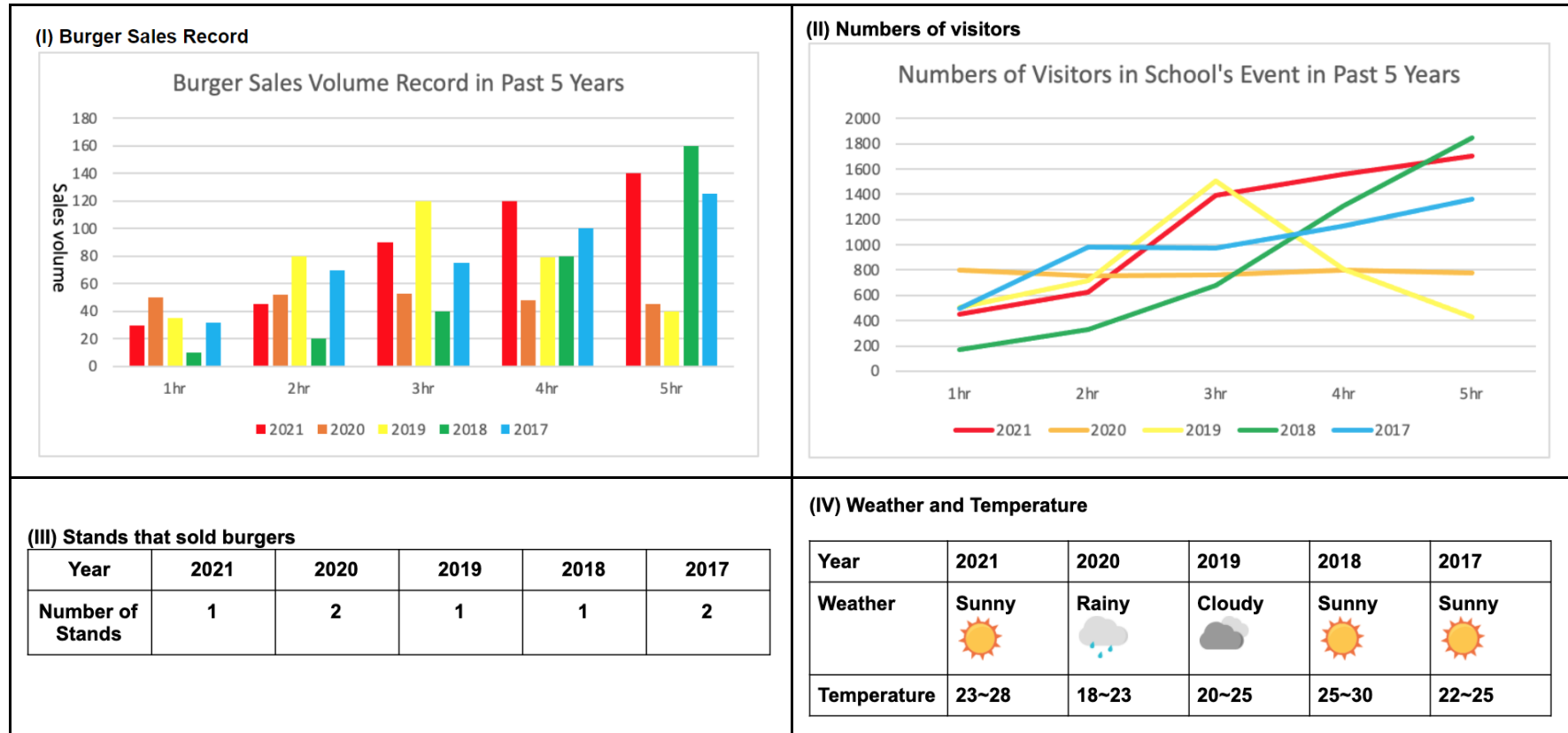
The linear equation:



II. Predict hamburger sales in school event:

Look at the information below. You can see data related to burger sales in the school event in the last 5 years. The sales volume can be affected by various factors, such as the weather, numbers of the visitors and so on. Based on the following information, please predict how many hamburgers your group could sell during each time slot in the upcoming school event.

You may take other factors into consideration if necessary. Fill in the blanks with your group's prediction. Remember, you must explain why. Do not make a wild guess!



Time Slot	1st hour	2nd hour	3rd hour	4th hour	5th hour
Hamburger sales	15	25			

III. Assume Time Slot is “ x ” and Hamburger sales is “ y ” and please complete the following table.

After the former discussion, you may find that there is more than one possibility to your prediction. You can use the given historical data and do some brainstorming with your teammates. Write down your own strategies. Plot the Equation you estimate. Predict the sales numbers with reasonable explanation. You need to come up with **at least 5** different strategies on how you predict the sales numbers. Each group will need to present your strategies and explain the reasons in front of the class.

	Strategy (Mathematical Tools)	Modeling: x,y Equation	Predicted sales numbers	Note (English) Explain why you choose the tool(s)?
1				
2				
3				
4				
5				

Linear Equations and Mathematical Modeling 教學指引

1. 問候同學(Greeting)+引言(Introduction)：

配合學習單 P.1~P.4

順序	教師發言
T1	(問候語) Good morning/afternoon class.
T2	(說明課程主題) Today, we'll continue our lesson on "Linear Equations and Mathematical Modeling".
T3	(帶同學了解今日課程的架構) First, we'll review some mathematical terms that we'll frequently use today. 一開始，我們會帶大家複習一些重要的專有名詞，這些名詞在我們今天的課程中都會反覆地出現，請同學務必要確定都了解了。
T4	Second, we have a few exercises for you. Hope all of you still remember what we've done in the last class. 接著，我們有一些上一堂課的練習題，希望大家都還記得我們曾經學過的東西，包含了點斜式，英文是？（提問：point-slope form）截距式，英文是？（再提問：intercept form）
T5	Finally, we'll move to the key point of today's class: the mathematical modeling.(數學建模) I'll give you a real-world problem. You can discuss with your teammates and make a prediction.

2. 進入課程(Review)

配合學習單 P.1~P.2

順序	教師發言
T1	(帶領同學完成學習單第一部分) Let's start with Section I. Review. In Section I, I am going to give you some mathematical terms in English and their "symbols". Please try to fill in the blanks on your own. I'll give you 5 minutes. 請同學利用五分鐘，完成第一部分的表格，大家可以利用上次的筆記與學習單上的圖式，回憶一下這些英文專有名詞所對應的中文是甚麼。
T2	(確認答案 I) A linear equation in Chinese is
T3	Okay. Let's move on to Section I (ii) and (iii). In Section I (ii) and (iii) you need to find out the equation of a line with

	<p>the given conditions and draw the line on the “Cartesian plane”.(笛卡爾座標=直角坐標) You’ll have another 5 to 10 minutes.</p> <p>接著，在第一部分後段，請同學利用上一堂課所學，利用給定的條件求出直線方程式並完成繪圖。在數學建模的過程中，我們要具備能夠把資料轉換為方程式的能力，並藉由繪圖嘗試評估未來可以的發展。我們再給同學們五到十分鐘，請大家完成第二頁的題目。</p>
T4	<p>(確認答案 II)</p> <p>Time’s up. Let’s discuss the answer together.</p> <p>(ii) (a) is the point-slope form(點斜式) so the answer is $y-7=5(x-2)$</p> <p>...</p>

3. 數學建模與應用(Mathematical modeling and application)

配合影片(無對應學習單)

順序	教師發言
T1	<p>(數學建模說明)</p> <p>After you learn about Linear equations, we can apply this concept to real-world problems. To do this, you have to know what “Mathematical Modeling “(數學建模) is.</p>
T2	Now, let’s take a look at the clip first.
T3	Attention! I want all of you to pay attention to 3 steps of modeling in the clip. And I want you to tell me what they are.
T4	<p>Let’s watch the video: https://www.youtube.com/watch?v=xHtsuOB-TPw</p> <p>(What is Math Modeling? Video Series Part 1: What is Math Modeling?)</p> <p>請同學注意看等等老師要播放的影片，影片雖然是英文的，但大家應該可以蠻容易抓出裡面的三個階段，影片我們會播放兩次，播放完後再請大家回答老師的問題。</p> <p>(播放影片)</p>
T5	<p>有沒有人可以說說看影片中點出的三個階段分別是甚麼？</p> <p>Now, who can tell me the 3 steps of modeling mentioned in the clip?</p> <p>(Define the problem → Make assumptions → Define variables)</p>
T6	In other words, when you see a problem, you think about how the problem can be solved, and you find possible ways to solve it.

4. 實際範例操作(Predict hamburger sales in school event)

配合學習單 P.3~P.4

順序	教師發言
T1	(帶領同學了解任務要求)

	Could I have someone read the instructions on Section II and Section III?
T2	Who can tell us what Section II wants us to do?
T3	<p>Good. You are given some historical data from Section II. Please discuss in your group. Come up with one prediction about the hamburger sales per hour. You may take other factors into consideration if necessary.</p> <p>我們在Section II 提供了一些過往的歷史資料給同學參考。請用這些資料和同學討論、預測校慶要每小時會賣出多少漢堡。如果需要的话，可以考慮不同的因素及面向，都可以接受。</p> <p>You have 5 minutes for this part. Now, go!</p>
T4	<p>(確認各組討論的結果與回饋)</p> <p>Have you finished? Group X, what did you find?</p>
T5	Alright! Let's move on to Section III and read the instructions together.
T6	<p>Very good! Now, work with your group members and come up with some reasonable models. Use mathematical tools you know and don't forget to tell us why you choose your models.</p> <p>接下來請大家依照你們各組剛剛預測所賣出的校慶漢堡個數來建模。也就是說寫出數學的關係式(方程式或函數)等等的數學工具來模擬實際情形，並且說出你們為什麼這樣建模。</p>
T7	<p>Your group has to finish this part before you go. Be prepared to present your group's modeling in the next class.</p> <p>大家要完成最後一部份的學習單，下次上課時，我們要請各組進行發表，跟大家說說你們是怎麼預測的，用了甚麼方法與函數。請大家把握剩下的時間！Let's go!</p>

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