

Seppo Teaching Plan - Mathematics Orientation In and Around School

Form: S3

Time: 90 minutes

Learning Objectives:

An end-of-year competition that acts as a comprehensive review of various topics throughout the whole junior Mathematics curriculum.

Cognitive Knowledge

Students should be able to:

- K1. recognise symmetric figures in daily life;
- K2. determine the average speed using the formula $speed = \frac{distance}{time}$;
- K3. recognise the relationship among the radius, circumference of a sector and the base radius, and slant height of a cone;
- K4. determine the volume of a cone using the formula $V = \frac{1}{3}\pi r^2 h$;
- K5. express the range of the weight of a piece of A4 paper using the maximum absolute error of a measurement;
- K6. recognise the relationship between the probability of hitting a target and the area on the target board;
- K7. apply the trigonometric ratios in solving problems in real-life situation.

Psychomotor Skills

Students should be able to:

- S1. measure angle of elevation using a clinometer.

Values and Attitude

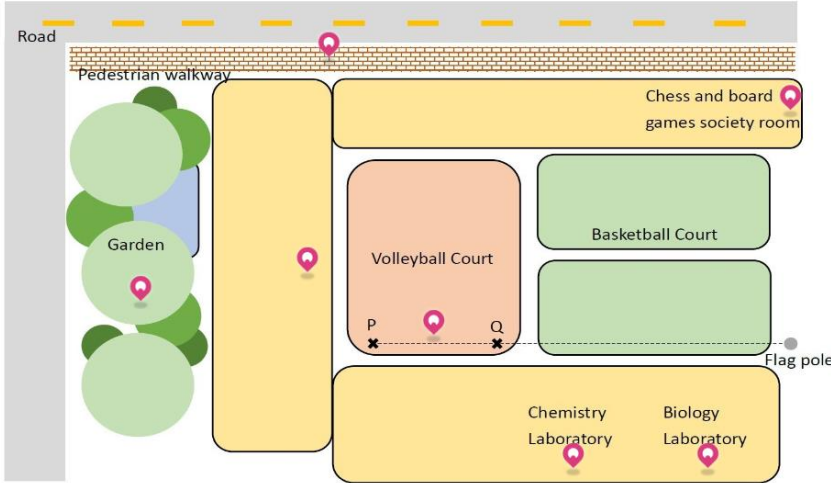

Students should be able to:


- V1. appreciate the usefulness of Mathematics by applying in real-life situation.





Related units for the Curriculum:

- Unit 6: Rates, ratios and proportions
- Unit 15: Errors in measurement
- Unit 18: Mensuration
- Unit 27: Trigonometry
- Unit 31: Probability


Teaching Procedures:

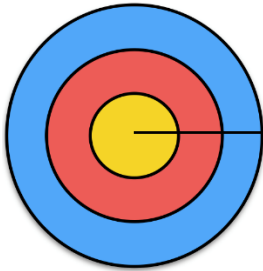


Stages	Time (mins)	Objectives	Procedures	Materials
Preparation	-	Teacher creates a map of your school, build customised activities with checkpoints using Seppo	 <ol style="list-style-type: none"> 1. Take the satellite map of your school off 'Google Map' or use a hand-drawn map. 2. Set the checkpoints for different activities: <ul style="list-style-type: none"> - For the symmetric shapes task: set a checkpoint in the classroom. - For the speed measuring task: set checkpoint in a pedestrian walkway near the school. - For the paper cone cup task: set a checkpoint in a Biology laboratory. - For the paper weighing task: set a checkpoint in a Chemistry laboratory. - For the target hitting task: set a checkpoint in the chess and boardgames society room. - For the clinometer task: set checkpoints in the garden and the volleyball court. 	<ol style="list-style-type: none"> 1. A Seppo instructor account 2. Sample activity: <p>Mathematics</p> <p>Orientation In and Around School</p> 

Pre-lesson	10	Briefing Students on the rules, guidelines and safety concerns of the activities	<ol style="list-style-type: none"> 1. Assign Students into groups of 4 to 5. 2. Inform Students the tasks and zone of activities. 	Smartphones or tablets (one per group), able to open Seppo (https://seppo.io/) (Recommend Chrome or Safari browser)
Checkpoint 1: Look everywhere	/	Finding symmetric figures	<ol style="list-style-type: none"> 1. Find objects with reflectional or rotational symmetry. 2. Take pictures of the objects. Draw the axis/axes of symmetry on the photos and upload them. <div data-bbox="898 611 1559 1145" style="background-color: #f0f0f0; padding: 10px; border: 1px solid #ccc;"> <p>Exercise type: Creative Maximum points: 5</p> <p>Task: Find objects of symmetric shape</p> <p>Look for objects in the whole school area with reflectional or rotational symmetry.</p> <p>Take pictures of the objects and draw the axis/axes of symmetry.</p> <p>Upload the images.</p> <p>Each object with correct description: 1 mark Maximum: 5 marks</p> <p>Build your answer:</p> <div style="display: flex; align-items: center; margin-top: 10px;">  Image </div> </div>	

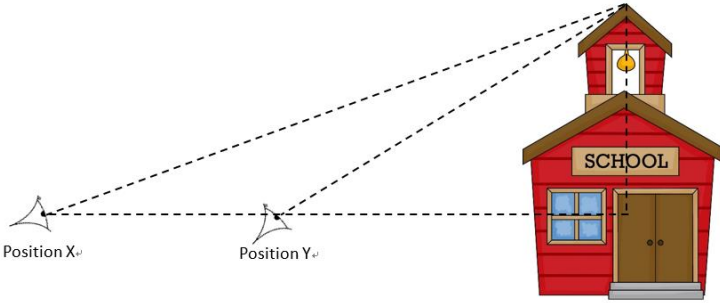
<p>Checkpoint 2: Fast and furious</p>	<p>15</p>	<p>Estimating the average speed of a vehicle</p>	<ol style="list-style-type: none"> Students go to the pedestrian walkway near a road. Record a video of a vehicle moving down a road. Find the distance travelled by the vehicle using the measuring wheel. Find the time taken for travel by watching the video recorded. Members of each group assign the roles among themselves: <ul style="list-style-type: none"> Two students to carry the flags and give signal. One student to record the process using a smart phone. One student to measure the distance using a measuring wheel. Students calculate the speed of the vehicle and upload the answer. Tip: Think about how to make use of the flags for a more accurate result. <div data-bbox="913 695 1496 1241" style="border: 1px solid #ccc; padding: 10px; margin: 10px 0;"> <p>Exercise type: Creative Maximum points: 6</p> <p>Task: Estimate the speed of a moving vehicle Speed = Distance / Time</p> <p>Record a video of a vehicle moving down a road.</p> <p>Find the distance travelled by the vehicle using the measuring wheel.</p> <p>Find the time taken by watching the video recorded.</p> <p>Think about how to make use of the flags for a more accurate result.</p> <p>Calculate the speed of the vehicle and express the answer in a) m/s and b) km/h</p> <p>Upload 1)the video and 2)a photo of the steps+answer</p> <p>Video: 1 mark Method: 2 marks Steps&Answer: 3 marks</p> </div> <div data-bbox="904 1273 1554 1382" style="text-align: center;">  </div> <div data-bbox="869 1382 1496 1433" style="text-align: center;"> <p>Student A  Student C  Student B </p> </div>	<p>2 Flags, a measuring wheel and a smart phone with camera for each group</p>
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<p>Checkpoint 3: Do not eat and drink in Bio lab!</p>	<p>10</p>	<p>Measuring the volume of a paper cone cup</p>	<ol style="list-style-type: none"> 1. Students go to the Biology laboratory. 2. Students measure the angle and radius of the paper cutout with protractor and ruler. 3. Students calculate the base radius, slant height, height and volume of the cone if the cutout is folded. 4. Students form the paper cone and pour water into the cup. 5. Students measure the actual volume of water using a measuring cylinder and calculate the percentage error. <div data-bbox="869 592 1462 1343" style="background-color: #f0f0f0; padding: 10px; margin-top: 20px;"> <p>Exercise type: Creative Maximum points: 5</p> <p>Task: Estimate the volume of a paper cone cup</p> <p>You are provided with a cutout of an unfolded paper cone, a protractor, a ruler, glue and a measuring cylinder.</p> <p>Part 1:</p> <p>Measure the angle and radius of the unfolded paper cutout.</p> <p>Question 1: If the paper cutout is folded into a cone, what is the height and base radius of the cone?</p> <p>Question 2: Calculate the volume of the cone using the formula.</p> <p>Part 2:</p> <p>Fold the cutout into a cone, then pour water into the cone cup.</p> <p>Measure the volume of water in the cup using the measuring cylinder.</p> <p>Question 3: Calculate the percentage error between the calculated volume and the measured volume.</p> <p>Upload your steps and answer as images.</p> <p>Measurement: 1 mark</p> <p>Question 1: 2 marks</p> <p>Question 2: 1 mark</p> <p>Question 3: 1 mark</p> </div>	<p>Cutouts of unfolded paper cone, glue, rulers, protractors, measuring cylinder and tap water</p>
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<p>Checkpoint 4: A sheet of A4 paper</p>	<p>10</p>	<p>Estimating the weight of one sheet of A4 paper</p>	<ol style="list-style-type: none"> 1. Students go to the Chemistry laboratory. 2. Students measure the weight of 500 sheets of A4 paper and state the maximum absolute error. 3. Students calculate the range (upper and lower limits) of the weight of one sheet of A4 paper. <div data-bbox="869 408 1462 903" style="background-color: #f0f0f0; padding: 10px; border: 1px solid #ccc;"> <p>Exercise type: Creative Maximum points: 4</p> <p>Task: Estimate the weight of one sheet of A4 paper Weigh 500 sheets of A4 paper with an electronic balance. Write down the maximum absolute error of the measurement. Calculate the range (upper and lower limits) of the weight of one sheet of A4 paper. Upload your steps and answer as an image. Steps and answer: 4 marks</p> <p>Build your answer:</p> <p> Image</p> </div>	<p>500 sheets of A4 paper and an electronic balance</p>
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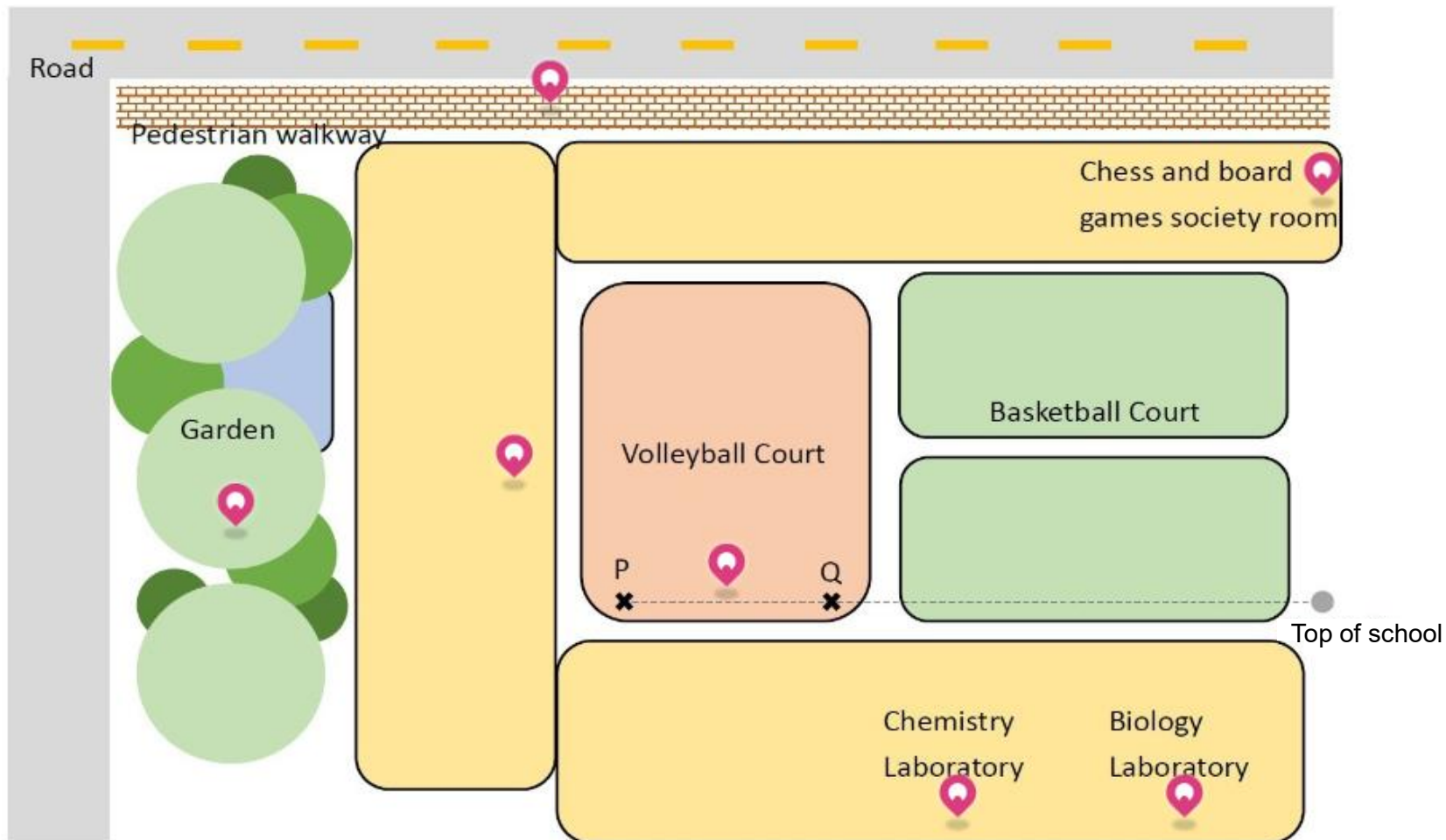
<p>Checkpoint 5: Bullseye (Optional)</p>	<p>10</p>	<p>Calculating the probability of hitting the bullseye</p>	<ol style="list-style-type: none"> Students go to the Chess and boardgames society room. Students measure the radius of the concentric circles on the target board.  <ol style="list-style-type: none"> Students calculate the probability of hitting the bullseye if a dart lands randomly on the board. Students record a video of a groupmate throwing a dart and upload the video. (Optional) Scores are assigned to different colored areas, calculate the expected value of score when randomly throwing a dart. <div data-bbox="902 858 1487 1329" style="border: 1px solid #ccc; padding: 10px; background-color: #f9f9f9;"> <p>Exercise type: Creative Maximum points: 3</p> <p>Task: Find the probability of hitting the bullseye</p> <p>Question: If a dart hits a random spot on the target board, what is the probability of it hitting the bullseye?</p> <p>You are provided with a ruler. Upload your steps and answer as an image.</p> <p>Record a video of any one of your groupmate hitting the bullseye.</p> <p>Video: 1 mark</p> <p>Steps and answer: 2 mark</p> <p>Build your answer:</p> <div style="display: flex; gap: 10px;"> <div style="border: 1px solid #ccc; padding: 5px; background-color: #f0f0f0; text-align: center;">  Image </div> <div style="border: 1px solid #ccc; padding: 5px; background-color: #f0f0f0; text-align: center;">  Video </div> </div> </div>	<p>Target board, ruler</p>
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<p>Checkpoint 6: Look up!</p>	<p>25</p>	<p>Estimating the height of a tall tree</p>	<ol style="list-style-type: none"> 1. Students go to the garden. 2. Measure the height of the eye level of an observer. 3. Measure the angle of elevation of the tree using a clinometer. 4. Measure the separation between the tree and the observer. 5. Calculate the height of the tree. <div data-bbox="869 421 1447 895" style="background-color: #f0f0f0; padding: 10px; margin-top: 10px;"> <p>Exercise type: Creative Maximum points: 5</p> <p>Task: Estimate the height of a tree</p> <p>You are provided with a clinometer and a tape measure.</p> <p>Measure the height of the eye level of the observer in your group.</p> <p>Measure the angle of elevation of the selected tree.</p> <p>Take a picture of the observer using the clinometer and the reading of the clinometer.</p> <p>Measure the distance between the tree and the observer.</p> <p>Calculate the height of the tree, upload the steps and answer as an image.</p> <p>Picture and measurement: 3 marks</p> <p>Steps and answer: 2 marks</p> </div>	<p>Clinometer, tape measure</p>
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<p>Checkpoint 7: Height of the School (Optional)</p>		<p>Estimating the height of the school</p>	<ol style="list-style-type: none"> 1. Students go to the volleyball court. 2. Measure the angle of elevation of the top of school from a certain position X. 3. Students walk a few steps forwards until arriving position Y, measure the angle of elevation again. 4. Measure the separation between position X and Y. 5. Students calculate the height of the school. <div data-bbox="875 497 1462 1011" style="border: 1px solid #ccc; padding: 10px; background-color: #f9f9f9;"> <p>Exercise type: Creative Maximum points: 5</p> <p>Task: Estimate the height of the flag pole You are provided with a clinometer and a tape measure. Measure the height of the eye level of the observer in your group. Measure the angle of elevation of the flag pole when observed from point P. Measure the angle of elevation of the flag pole when observed from point Q. Measure the distance between points P and Q. Estimate the height of the flag pole, upload your steps and answer as an image.</p> <p>Measurement: 2 marks Steps and answer: 3 marks</p> </div> <div data-bbox="891 1034 1608 1337" style="text-align: center;">  </div>	
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Post-task	10	Conclude the competition and announce the winner	<ol style="list-style-type: none"> 1. Students return to the classroom. 2. Teacher gives a brief review on the knowledge related to the tasks. 3. Teacher computes the total points of each group and announces the winner. 	
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Sample school map with checkpoints



Seppo 教學建議 - 在學校與周邊進行數學遊蹤

學級: S3

時間: 90 分鐘

學習目標:

於學期終進行一場數學科比賽，以總結及回顧課程中的不同課題。

知識

學生應能

- K1. 辨識出日常生活中的對稱圖形。
- K2. 運用公式 $\text{速率} = \frac{\text{距離}}{\text{時間}}$ 計算平均速率。
- K3. 辨識半徑、扇形的周長與半徑，以及圓錐體傾斜高度之間的關係。
- K4. 運用公式 $V = \frac{1}{3}\pi r^2 h$ 計算錐體的體積。
- K5. 利用最大絕對誤差概念量度一張 A4 紙張的重量範圍。
- K6. 辨識中鏢概率與鏢盤面積之間的關係。
- K7. 應用三角比率來解決現實生活中的問題。

技能

學生應能

- S1. 使用測斜儀來量度仰角。

價值觀和態度

學生應能

- V1. 明白數學的用處並將數學知識應用在日常生活中。

相關課程單元：

單元 6：率、比及比例

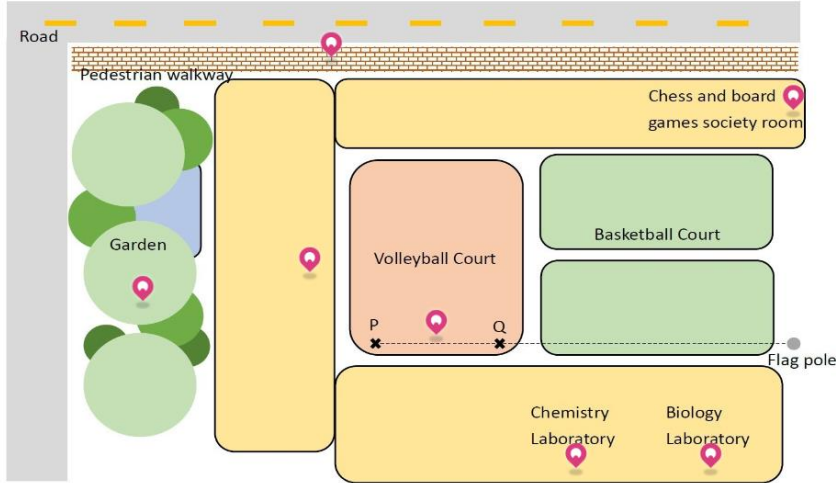

單元 15：量度的誤差


單元 18：求積法


單元 27：三角學

單元 31：概率


教學步驟:

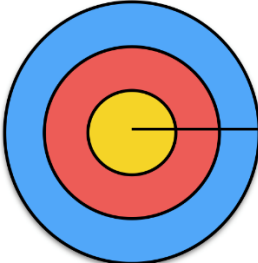


階段	時間 (分鐘)	目標	步驟	材料
準備	-	教師自設學校地圖，並設定任務	 <ol style="list-style-type: none"> 1. 從 Google 地圖選取學校範圍的衛星地圖或使用一張自製地圖均可。 2. 設置不同活動任務，例如： <ul style="list-style-type: none"> 於課室設置對稱圖形任務。 於學校附近的人行道設置速度測試任務。 於生物實驗室設置圓錐體紙杯任務。 於化學實驗室設置紙張測重任務。 於棋牌活動室設置扔飛鏢任務。 於花園及排球場設置測高任務。 	<ol style="list-style-type: none"> 1. Seppo 帳戶 2. 參考活動 (英文版): <p>Mathematics Orientation In and Around School</p> 

<p>比賽前</p>	<p>10</p>	<p>教師向學生簡述是次比賽的規則及安全指引</p>	<ol style="list-style-type: none"> 1. 將學生分組，每組約 4-5 人。 2. 向學生介紹比賽的任務及活動範圍。 	<p>每組學生所備的智能手機均需能打開 Seppo 網頁（建議使用 Chrome 或 Safari 瀏覽器） (https://seppo.io/)。</p>
<p>任務一 東張西望</p>	<p>-</p>	<p>找出對稱圖形</p>	<ol style="list-style-type: none"> 1. 找出反射或旋轉對稱的物體。 2. 拍攝該物體的相片，在相片上畫出對稱軸並上傳圖像。 <div data-bbox="837 560 1496 1098" style="background-color: #f0f0f0; padding: 10px; border: 1px solid #ccc;"> <p>Exercise type: Creative ^ Maximum points: 5</p> <p>Task: Find objects of symmetric shape</p> <p>Look for objects in the whole school area with reflectional or rotational symmetry.</p> <p>Take pictures of the objects and draw the axis/axes of symmetry.</p> <p>Upload the images.</p> <p>Each object with correct description: 1 mark Maximum: 5 marks</p> <p>Build your answer:</p> <div style="text-align: center;">  <p>Image</p> </div> </div>	

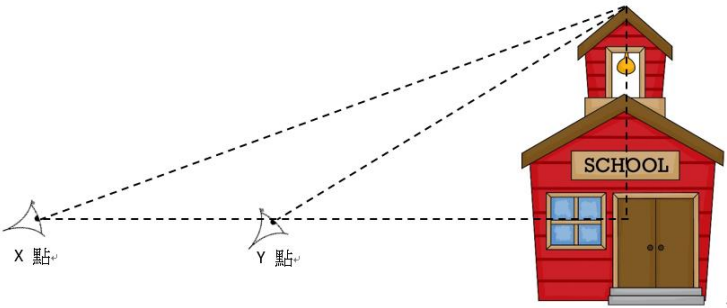
<p>任務二 速度與激情</p>	<p>15</p>	<p>估算一輛車的平均 速率</p>	<ol style="list-style-type: none"> 1. 抵達學校附近路邊的行人路。 2. 拍攝一輛車在馬路上行駛的短片。 3. 利用滾輪尺量度車輛的行駛距離。 4. 通過觀看短片找出車輛的行駛時間。 5. 每組學生自行分工： <ul style="list-style-type: none"> - 兩名學生負責手持旗幟和發出信號 - 一名學生負責用智能手機錄製影片 - 一名學生使用滾輪尺量度距離 6. 學生計算出該車的車速並將答案上傳。 <p>提示：試想想如何利用旗幟提升量度的準確度。</p> <div data-bbox="846 639 1429 1350" style="background-color: #f0f0f0; padding: 10px; border: 1px solid #ccc;"> <p>Exercise type: Creative Maximum points: 6</p> <p>Task: Estimate the speed of a moving vehicle</p> <p>Speed = Distance / Time</p> <p>Record a video of a vehicle moving down a road.</p> <p>Find the distance travelled by the vehicle using the measuring wheel.</p> <p>Find the time taken by watching the video recorded.</p> <p>Think about how to make use of the flags for a more accurate result.</p> <p>Calculate the speed of the vehicle and express the answer in a) m/s and b) km/h</p> <p>Upload 1)the video and 2)a photo of the steps+answer</p> <p>Video: 1 mark Method: 2 marks Steps&Answer: 3 marks</p> <p>Build your answer:</p> <div style="display: flex; gap: 10px;"> <div style="border: 1px solid #ccc; background-color: #e0e0e0; padding: 5px; text-align: center;">  Image </div> <div style="border: 1px solid #ccc; background-color: #e0e0e0; padding: 5px; text-align: center;">  Video </div> </div> </div>	<p>每組 2 面旗幟、1 個滾輪尺和 1 個配備鏡頭的智能手機</p>
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<p>任務三 生物室內不准 飲食！</p>	<p>10</p>	<p>量度圓錐體紙杯的 體積</p>	<ol style="list-style-type: none"> 學生抵達生物實驗室。 學生將尖底紙杯圖樣攤平，使用量角器和尺子量度半徑和角度。 學生計算該紙杯摺疊後的半徑、傾斜高度、高度和體積。 學生將紙杯摺疊，並注滿水。 學生使用量筒找出注入的水的實際體積，並計算百分誤差。 <div data-bbox="837 592 1435 1351" style="background-color: #f0f0f0; padding: 10px; border: 1px solid #ccc;"> <p>Exercise type: Creative Maximum points: 5</p> <p>Task: Estimate the volume of a paper cone cup</p> <p>You are provided with a cutout of an unfolded paper cone, a protractor, a ruler, glue and a measuring cylinder.</p> <p>Part 1:</p> <p>Measure the angle and radius of the unfolded paper cutout.</p> <p>Question 1: If the paper cutout is folded into a cone, what is the height and base radius of the cone?</p> <p>Question 2: Calculate the volume of the cone using the formula.</p> <p>Part 2:</p> <p>Fold the cutout into a cone, then pour water into the cone cup.</p> <p>Measure the volume of water in the cup using the measuring cylinder.</p> <p>Question 3: Calculate the percentage error between the calculated volume and the measured volume.</p> <p>Upload your steps and answer as images.</p> <p>Measurement: 1 mark</p> <p>Question 1: 2 marks</p> <p>Question 2: 1 mark</p> <p>Question 3: 1 mark</p> </div>	<p>尖底紙杯圖樣，膠水，直尺，量角器，量筒和自來水</p>

<p>任務四 一張紙的重量</p>	<p>10</p>	<p>估算一張 A4 紙張 的重量</p>	<ol style="list-style-type: none"> 1. 學生抵達化學實驗室。 2. 學生量度 500 張 A4 紙張的重量並列出最大絕對誤差。 3. 學生計算 1 張 A4 紙的重量範圍（最大及最小）。 <div data-bbox="869 312 1464 807" style="background-color: #f0f0f0; padding: 10px; border: 1px solid #ccc;"> <p>Exercise type: Creative Maximum points: 4</p> <p>Task: Estimate the weight of one sheet of A4 paper Weigh 500 sheets of A4 paper with an electronic balance. Write down the maximum absolute error of the measurement. Calculate the range (upper and lower limits) of the weight of one sheet of A4 paper. Upload your steps and answer as an image. Steps and answer: 4 marks</p> <p>Build your answer:</p> <div style="text-align: center;">  Image </div> </div>	<p>500 張 A4 紙張和電子 磅</p>
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任務五 飛鏢靶 (如適用)	10	計算飛鏢中靶的概 率	<ol style="list-style-type: none"> 學生抵達棋牌活動室。 學生量度靶盤上的同心圓半徑。  <ol style="list-style-type: none"> 假設飛鏢以隨機概率擊中靶盤，計算正中靶心的概率。 每組學生投擲飛鏢，拍攝過程並上傳。 (非必選) 為同心圓的不同色域設置不同分數，假設飛鏢以隨機概率擊中靶盤，計算預期得分。 <div data-bbox="907 762 1489 1232" style="background-color: #f0f0f0; padding: 10px; border: 1px solid #ccc;"> <p>Exercise type: Creative Maximum points: 3</p> <p>Task: Find the probability of hitting the bullseye</p> <p>Question: If a dart hits a random spot on the target board, what is the probability of it hitting the bullseye?</p> <p>You are provided with a ruler. Upload your steps and answer as an image.</p> <p>Record a video of any one of your groupmate hitting the bullseye.</p> <p>Video: 1 mark</p> <p>Steps and answer: 2 mark</p> <p>Build your answer:</p> <div style="display: flex; gap: 10px;"> <div style="background-color: #e91e63; color: white; padding: 5px; border-radius: 5px; text-align: center;">  Image </div> <div style="background-color: #e91e63; color: white; padding: 5px; border-radius: 5px; text-align: center;">  Video </div> </div> </div>	靶盤, 尺
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<p>任務六 抬頭望！</p>	<p>25</p>	<p>估算大樹的高度</p>	<ol style="list-style-type: none"> 1. 學生抵達花園。 2. 量度站立的學生眼睛距離地面的高度。 3. 使用測斜儀量度該學生望向大樹的仰角。 4. 量度大樹與學生的間距。 5. 計算大樹的高度。 <div data-bbox="869 422 1451 896" style="border: 1px solid #ccc; padding: 10px; margin-top: 20px;"> <p>Exercise type: Creative Maximum points: 5</p> <p>Task: Estimate the height of a tree</p> <p>You are provided with a clinometer and a tape measure.</p> <p>Measure the height of the eye level of the observer in your group.</p> <p>Measure the angle of elevation of the selected tree.</p> <p>Take a picture of the observer using the clinometer and the reading of the clinometer.</p> <p>Measure the distance between the tree and the observer.</p> <p>Calculate the height of the tree, upload the steps and answer as an image.</p> <p>Picture and measurement: 3 marks Steps and answer: 2 marks</p> </div>	<p>測斜儀、捲尺</p>
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<p>任務七 學校最高點 (如適用)</p>		<p>估算學校最高點的高度</p>	<ol style="list-style-type: none"> 1. 學生抵達排球場。 2. 學生從某 X 點，量度學校最高點的仰角。 3. 學生向前走向某 Y 點，再次測量學校最高點的仰角。 4. 學生測量 X 點與 Y 點之間的距離。 5. 學生計算學校最高點的高度。 <div data-bbox="875 400 1464 916" style="border: 1px solid #ccc; padding: 10px; background-color: #f9f9f9;"> <p>Exercise type: Creative Maximum points: 5</p> <p>Task: Estimate the height of the flag pole</p> <p>You are provided with a clinometer and a tape measure.</p> <p>Measure the height of the eye level of the observer in your group.</p> <p>Measure the angle of elevation of the flag pole when observed from point P.</p> <p>Measure the angle of elevation of the flag pole when observed from point Q.</p> <p>Measure the distance between points P and Q.</p> <p>Estimate the height of the flag pole, upload your steps and answer as an image.</p> <p>Measurement: 2 marks</p> <p>Steps and answer: 3 marks</p> </div> <div data-bbox="891 938 1615 1246" style="text-align: center;">  </div>	
<p>總結</p>	<p>10</p>	<p>教師統籌評分並宣佈冠軍</p>	<ol style="list-style-type: none"> 1. 學生返回課室。 2. 教師簡述並總結比賽中不同任務的學習重點。 3. 教師計算每組學生得到的總分並宣佈賽果。 	

學校地圖之示例

