Teacher Notes for Diagrams

Compatibility: TI-83+/83+SE/84+/84+SE

Run The Program Called: **DGM1** or **DGM2**

▶ Summary

This program provides students with practice of drawing diagrams in order to answer questions that are presented to them as text only. These include simple geometrical constructions, angles of elevation and depression, bearings and compass-and-ruler constructions of triangles. They may be solved using algebraic methods (Pythagoras' Theorem or Trigonometry) or by construction of scale drawings. See **Appendix 1** for examples of each type of the 12 types of problem.

The unique feature of the program is that it will present a step-by-step solution of how to construct a scale drawing, with both a textual description and an animation of each step. See **Appendix 2** for an example of this.

Students obtain a percentage score based upon the accuracy of their submitted answers.

▶ Suggestions

The program can be used with the lower years to practise the construction of scale drawings with a clear emphasis on accuracy of measuring both the angles and the lengths.

Experienced students can tackle the more complex diagrams, as well as opting to solve them using trigonometry. Either way, they still nurture the skill of drawing sketch diagrams from text-only descriptive questions.

Providing students with plain paper to work on, rather than squared paper, has been found to be helpful to stress the need for accuracy using both a protractor and a ruler (and a sharp pencil!)

▶ Features

- Due to memory limitations, "Diagrams" has been split into two separate programs, stored in two separate groups: **DIAGRAM1** and **DIAGRAM2**.
- You must clear the RAM memory before ungrouping (press **2nd**, press **+**, press **7**, press **1**, press **2**) to ensure sufficient space is available. Ungroup **DIAGRAM1** and run the program **DGM1**, or ungroup **DIAGRAM2** and run **DGM2**. The program file **DGMX** is common to both parts.

DIAGRAM1 includes the following problems:

QUADRILATERAL GEOMETRY	**SQUARE**: Draw a square of given side length. Work out the length of its diagonal.
	RECTANGLE: Draw a rectangle of given dimensions. Work out the length of its diagonal and the angle between the diagonal and one of the longest sides.
	RHOMBUS: Draw a rhombus of given side length and given interior angles. Work out the length of either the shortest or longest diagonal.
ANGLES OF ELEVATION	**ONE ANGLE**: Work out the height of a tower knowing the angle of elevation from a point of known distance from the base.
	TWO ANGLES: Work out the height of a tower knowing the angles of elevation from two points at ground level, whose distance apart is known

cont/

ANGLES OF DEPRESSION	Work out the distance between two points knowing the angles of depression of each, and the vertical distance that they are below the point of observation.
ELEVATION & DEPRESSION	Work out the altitude of a point knowing its angles of elevation and depression from two points a known vertical distance apart.
BEARINGS	**TWO 1 STAGE JOURNEYS:** Two ships depart the same port on different bearings and go different distances. Work out their final distance apart and the bearing of one from the other. **TWO STAGE JOURNEY:** One ship departs from a port on a bearing and travels a distance. It then starts on a second leg of the journey with a new bearing and travels a new distance. Work out the final distance from port and the bearing of either the ship from the port, or the port from the ship

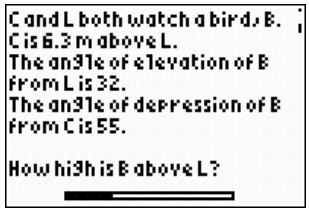
DIAGRAM2 includes the following problems:

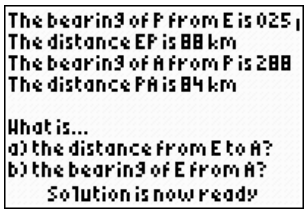
- construct a triangle given the lengths of all 3 sides (SSS) and work out its area.
- construct a triangle given two sides and an angle (SAS) and work out its perimeter and/or area
- construct a triangle given a side and two angles (SAA) and work out its perimeter and/or area

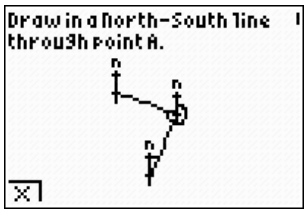
Where the area of a triangle is required, the step-by-step solution provides a hint to measure the altitude of the triangle, supporting the use of $A = \frac{1}{2}bh$, but clearly $A = \frac{1}{2}ab\sin C$ is an alternative method that could be used (and may indeed be more appropriate). The "base and height" method was chosen to support the progress of students who have not yet met trigonometry.

- All menus offer the opportunity of **RANDOM CHOICE**, allowing students to "test themselves" once they have become familiar with the program and the questions that it contains.

- After the question type has been selected, a question is designed and then displayed. Once the question is in view, a progress bar along the foot of the screen indicates the program's headway through the construction of the step-by-step solution. Only once this is complete can the user move on from the question screen to the next stage.

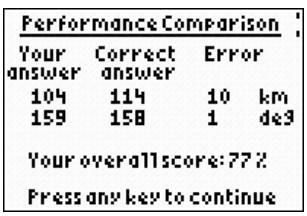






- Where **BEARINGS** questions are chosen, the step-by-step solution advises the user to drawn "North-South" lines, rather than just North lines. This is judged to be more helpful when solving bearings problems algebraically, as they better assist the student in identifying alternate angles in the diagram between the parallel North-South lines. It has also been found to assist the weaker students with bearings of greater than 180°.

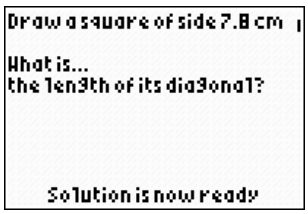
- When answering **BEARINGS** questions, the angle is required to have three figures. e.g. 047°

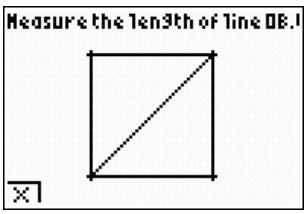


Appendix 1 - Examples of each of the 12 Problems

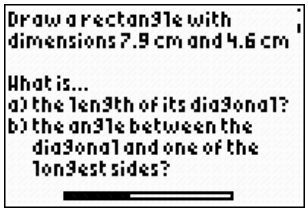
- Each problem's labels, lengths and angles are randomly generated according to designed criteria. The text generally remains unchanged.

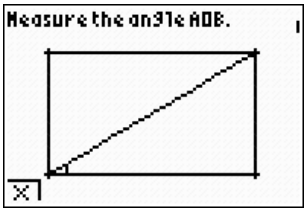
DGM1
Quadrilateral Geometry — Square



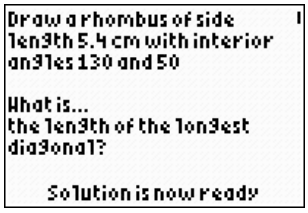


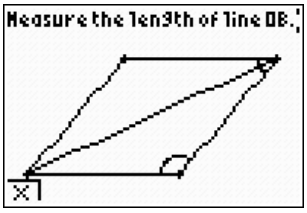
DGM1
Quadrilateral Geometry — Rectangle



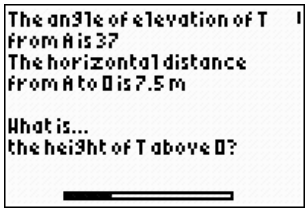


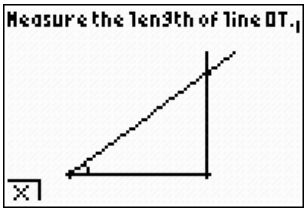
DGM1
Quadrilateral Geometry — Rhombus



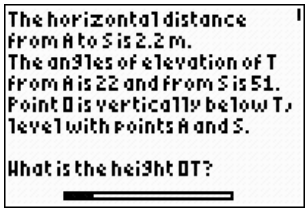


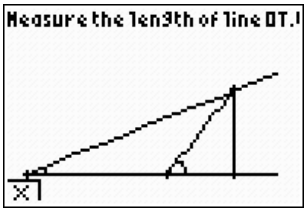
DGM1
Angles of Elevation — One Angle



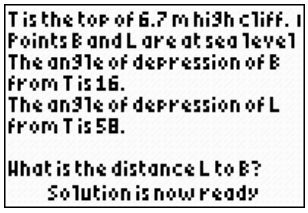


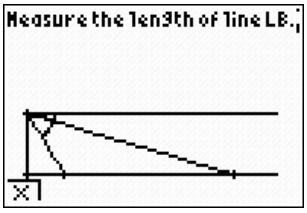
DGM1
Angles of Elevation — Two Angles



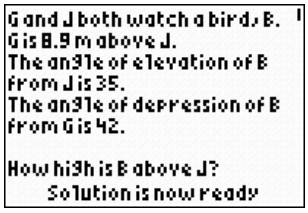


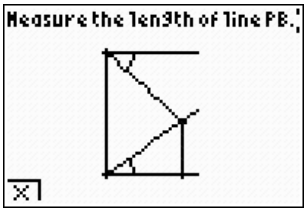
DGM1
Angles of Depression



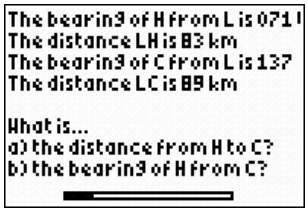


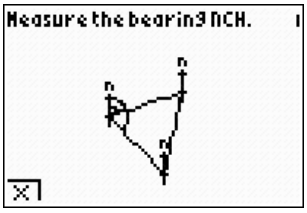
DGM1
Elevation + Depression



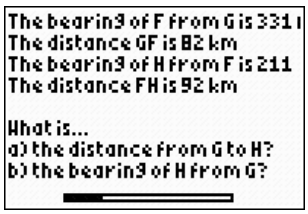


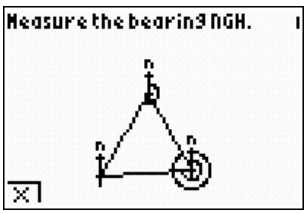
DGM1
Bearings — Two 1 Stage Journeys



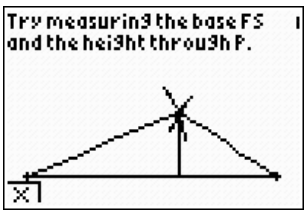


DGM1
Bearings — Two Stage Journey

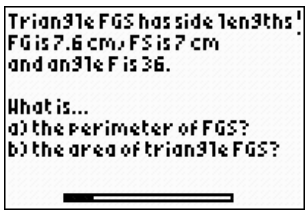


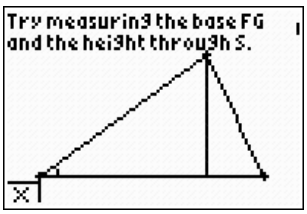


DGM2
SSS (side-side-side)

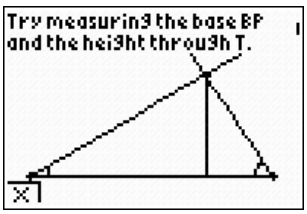


DGM2
SAS (side-angle-side) — Perimeter+Area *(although you can opt for only one of these if you wish)*



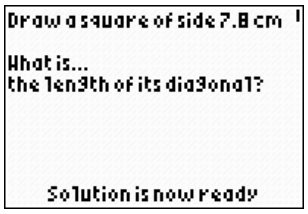


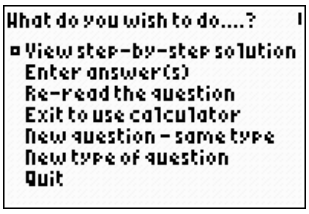
DGM2
SAA (side-angle-angle) — Perimeter+Area *(although you can opt for only one of these if you wish)*

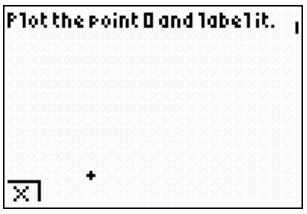


Appendix 2 - Example of a Step-by-Step Solution

Example question: DGM1 > Quadrilateral Geometry > Square

1. 

2. 

3. 

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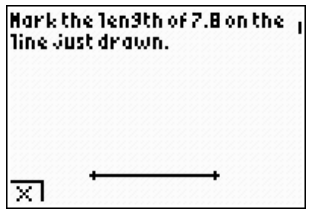
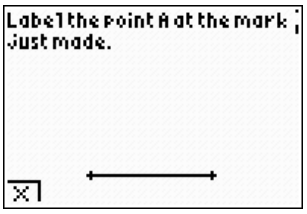
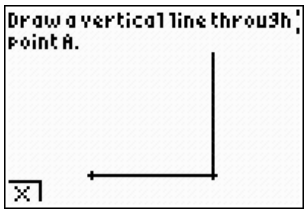
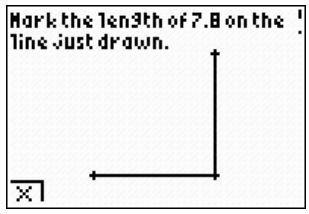
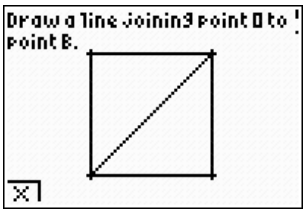
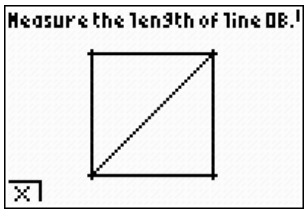
5. 

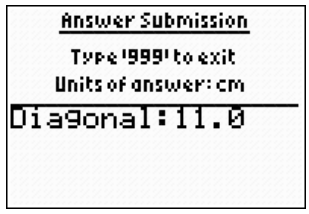
6. 

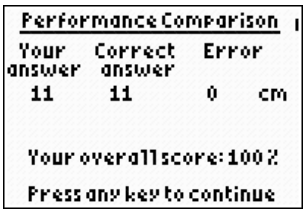
7. 

8. 

9. 

10. 

11. 

12. 

Notes:

- at any stage of the solution, the **Y=** button can be pressed to **QUIT** back to screenshot number two.
- the user does not need to view the step-by-step solution before opting to enter their answer.
- if the user, in error, opts to enter an answer before they are ready to, entering "999" as the answer returns them to screenshot number two, with no penalty.
- the user may temporarily exit the program to use the calculator's normal functions (useful when solving the problems with Pythagoras, trigonometry or when processing an area calculation). Select the "Exit to use calculator" from screenshot number two. After the required calculations are done, re-running the program (either DGM1 or DGM2) returns the user to screenshot number two as if no interruption had happened.
- once an answer is submitted, the performance percentage score is calculated. Answers within 2° of the correct angle and within 2mm of the correct length will return scores of over 90%. Beyond these limits, the penalties increase, giving lower performance scores.
- once an answer is submitted, it cannot be altered.

▶ Acknowledgements

A section of code used in this program is gratefully acknowledged to Raymond Bonneau.