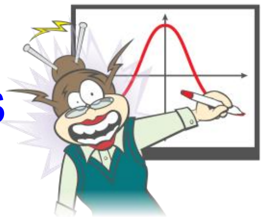
Effective calculator use in the Further Mathematics Graphs & Relations module



Author: David Tynan

Each of the questions included here can be solved using the TI-Nspire CX technology.

Problem 1

Jemima sometimes drives to work in the city from the outer suburb where she lives.

The relationship between the average speed for the journey (in km/h) and the time (in hours) it takes her to reach the work has the form

$$\textit{average speed} = \frac{k}{\textit{time}}$$

On the worst days for traffic, Jemima's drive to work takes two and a half hours at an average speed of 32 km/h. On the best days for traffic, her drive to work takes 1 hour and 15 minutes at an average speed of 64 km/h.

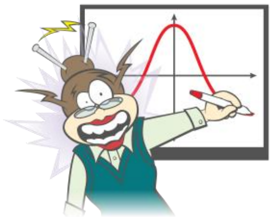
a. Find the value of *k*.

b. Draw a graph of the relationship between average speed and $\frac{1}{\textit{time}}$. Interpret the gradient of this graph.

c. Draw a graph of the relationship between average speed and time.

d. If Jemima could increase her average speed from 50 to 100 km/h, how much time would this save per trip?

Response:



Problem 2

Gerri and Massimo's house is located 700m in a direct line from the train station.
At 3 pm, Gerri is at the house and Massimo is at the station.
At that time, Gerri leaves the house and walks towards the station to go to work.
At the same time, Massimo leaves the station and walks towards the house.
Gerri's planned walk is modelled by the equation

$$g = \begin{cases} 100t, & 0 \le t \le 2 \\ 80t + 40, & 2 < t \le 6 \\ 60t + 160, & 6 < t \le 9 \end{cases}$$

where g is Gerri's distance, in metres, from the house after t minutes.
Massimo's planned walk is modelled by the equation

$$m = -70t + 700, \quad t \ge 0$$

where m is Massimo's distance, in metres, from the house after t minutes.

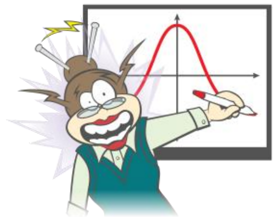
a. After how many minutes and seconds do their paths cross?

b. How far has Massimo travelled when their paths cross?

c. What time does Gerri arrive at the station?

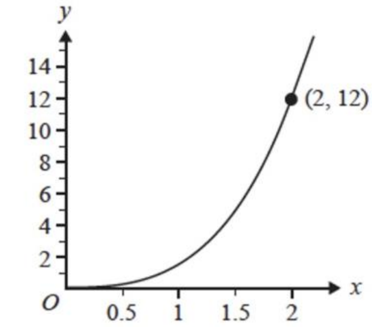
d. At what speed in kilometres per hour would Massimo need to have walked to arrive at the station at the same time as Gerri arrived at the house (rounded to 2 significant figures)?

Response:



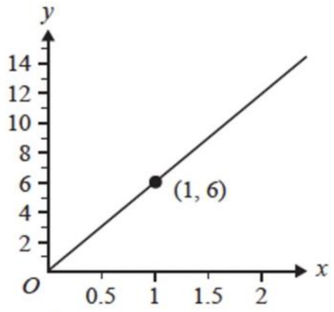
Problem 3

The point (2, 12) lies on the graph of $y = kx^n$, as shown right.

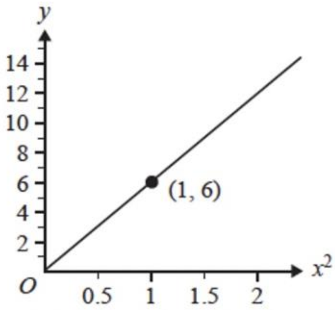


Another graph that represents this relationship between y and x could be

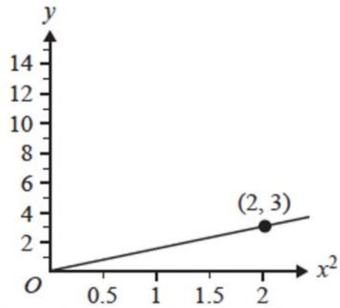
A.



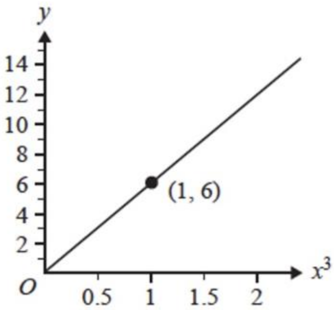
B.



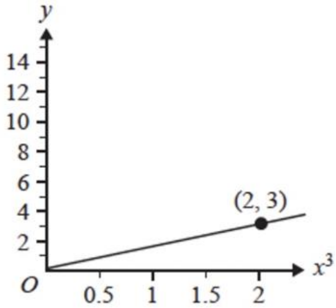
C.



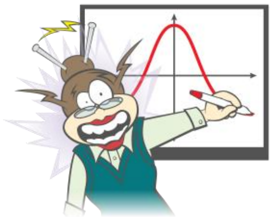
D.



E.



Response: ____



Problem 4

Members of a dancing club are attending a regional competition by car and minibus, generously subsidised by the local council.

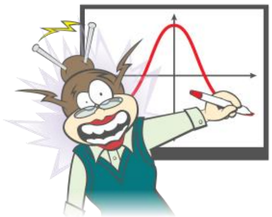
- Let x be the number of cars used for travel.
- Let y be the number of minibuses used for travel.
- A maximum of 8 vehicles can be used.
- At least 2 cars must be used.
- At least 3 minibuses must be used.
- Each car can carry 5 people and each bus can carry 10 people.
- A maximum of 60 people can attend the competition.
- The subsidised cost to hire each car is $30, and each minibus will cost $40.

a. What is the minimum cost that meets the above conditions, and how many cars and buses does this involve? How many people can attend in this case?

b. What is the minimum cost to take 50 people, and how many cars and buses does this involve?

c. If 4 cars and 4 buses are taken, then 60 people can attend. What is the cost of this, and is there a cheaper option that still permits 60 people to attend?

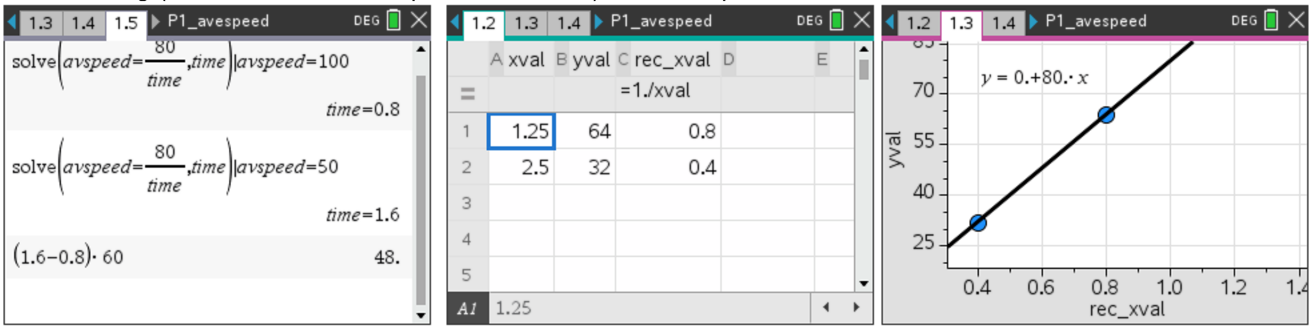
Response:



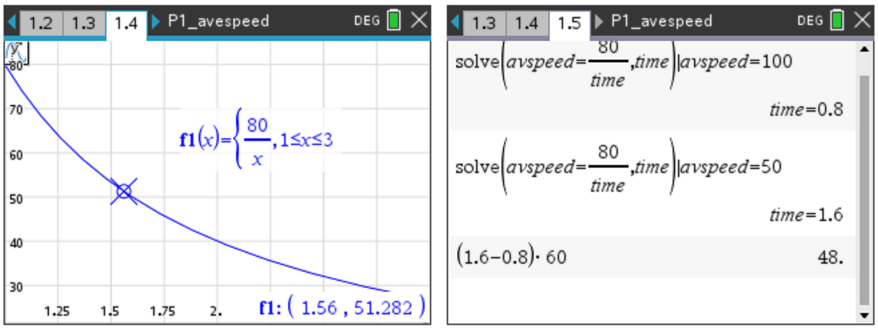
Answers

Problem 1

a. & b. Using (time = 2.5 hrs, ave. speed = 32 km/h), k = ave speed x time = 32 x 2.5 = 80.

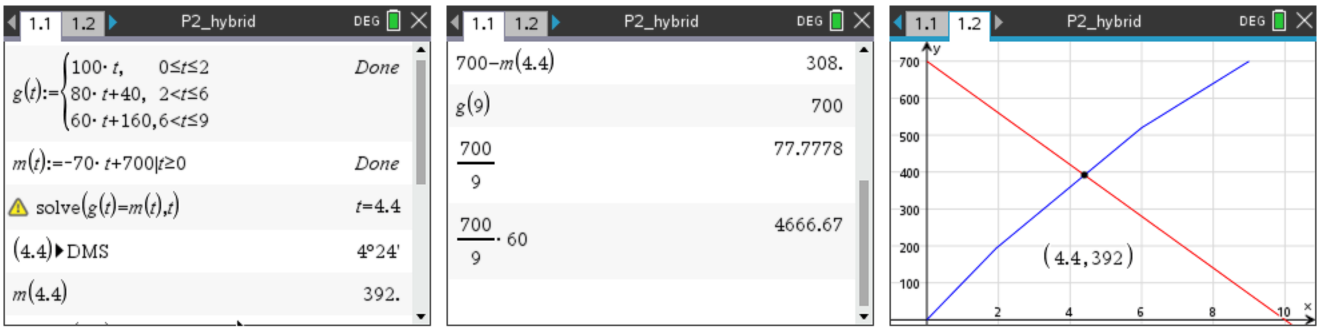


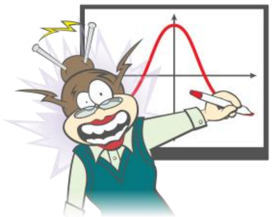
c. & d.



Problem 2

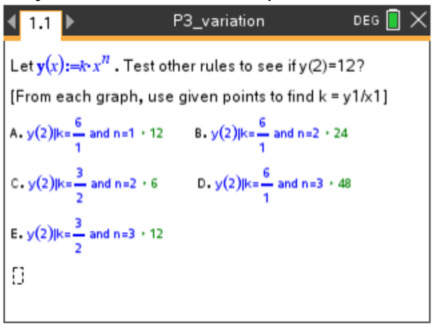
a. 4.4 minutes, or 4 minutes and 24 seconds
b. Massimo has walked 700 – 392 = 308 metres.
c. Gerri arrived at 3:09 pm
d. Massimo needs to cover 700 metres in 9 minutes, so 700 m/9 min = 77.7…m/min = 4666.6 … m/hr = 4.7 km/h.





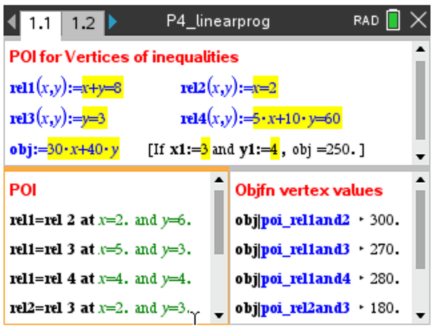
Problem 3

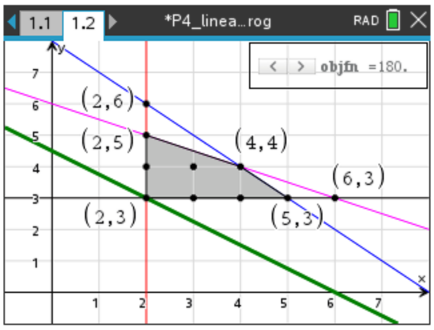
Let $y = kx^n$. Test each option in turn to see if $y(2) = 12$. Use the given point ($x1$, $y1$) to find k on each case.



Problem 4

a. The minimum cost is at the point (2,3), with a cost of $180.
   This will mean 2 x 5 + 3 x 10 = 40 people can attend.

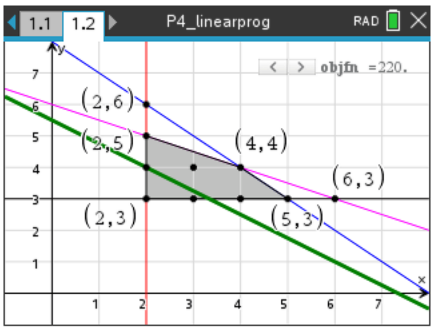


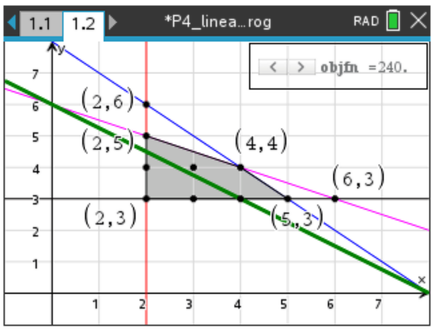


b. Taking 50 people means either
   - (2,4) 2 cars and 4 buses or
   - (4,3) 4 cars and 3 buses

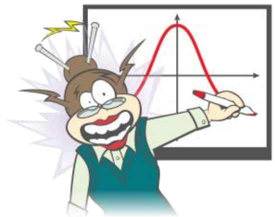
Using the sliding objective function line, or the following calculations:

- the cost for (2,4) is 2 x 30 + 4 x 40 = $220
- the cost for (4,3) is 4 x 30 + 3 x 40 = $240



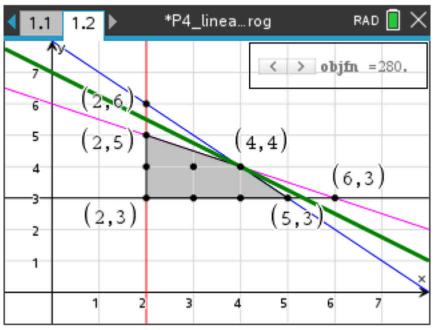


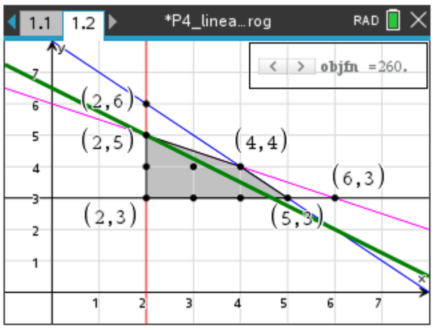
So it is cheaper to take 2 cars and 4 buses.



c. Using the sliding objective function line, or the following calculations , taking 60 people in 4 cars and 4 buses people means the cost for (4,4) is 4 x 30 + 4 x 40 = $280.

However, taking 2 cars and 5 buses also permits taking 60 people at a cost of 2 x 30 + 5 x 40 = $260.





So it is cheaper to take 2 cars and 5 buses if 60 people are to attend the competition.