The price of soda at Big Boberta’s slurpee store is $1.50 per liter. If a customer buys a minimum of 10 liters, a discount of $5 is applied.

This can be modelled by the following function, *L* , which gives the total cost when buying a minimum of 10 liters at Big Boberta’s slurpee store.

*L*(*x*) = 1.50*x* - 5 , *x* ≥ 10

where *x* is the number of liters of soda that a customer buys.

(a) Find the total cost of buying 40 liters of soda at Big Boberta’s gas station. [2]

(b) Find . [2]

The price of soda at Slippery Sam’s Gastro Pub is $1.30 per liter. A customer must buy a minimum of 10 liters of soda. The total cost at Slippery Sam’s Gastro Pub is cheaper than Big Boberta’s slurpee store when *x* > *k* .

(c) Find the minimum value of *k* . [3]

Number 5:  
  
The Voronoi diagram below shows three food carts selling carnitas, T1, T2 and T3.

A fourth food cart, selling carnitas, T4 is located in the shaded region. The dashed lines in the diagram below represent the edges in the Voronoi diagram.

https://dl.dropboxusercontent.com/scl/fi/8f7gfa2oemdhe8x5py1a8/p1.2021.tz1.5.jpg

JoseLuis stands inside the shaded region.

(a) Explain why JoseLuis will get the strongest smells from the food cart in T4. [1]

Food card T2 has coordinates (-9 , 5) and the edge connecting vertices A and B has

equation *y* = 3 .

(b) Write down the coordinates of tower T4. [2]

Tower T1 has coordinates (-13 , 3) .

(c) Find the gradient of the edge of the Voronoi diagram between towers T1 and T2. [3]  
  
Answer Key:  
  
a) every point in the shaded region is closer to T4.  
b) (-9,1) or (-9, 1)  
c) ½ or 0.5 or .5

Question 6: topic – Statistics  
  
Eileen is a baker. She makes brownies. She claims that when she uses flour brand X, the mean weight of her browns is less than when she uses flour brand Y.   
  
She records the weight of the brownies, in grams, from a random selection of batches of brownies made with one flour or the other.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Brownies made from flour X | 136 | 134 | 142 | 141 | 128 | 126 |
| Brownies made from flour Y | 135 | 138 | 141 | 140 | 136 | 134 |

In order to test her claim, Eileen performs a *t*-test at a 10% level of significance. It is assumed that the weights of the eggs are normally distributed and the samples have equal variances.  
  
(a) State, in words, the null hypothesis. 1 point  
(b) Calculate the *p*-value for this test. 2 points  
(c) Do we reject the null or fail to reject the null? 2 points  
  
Answer key  
  
(a) H0: The population mean weight of eggs from (her/the) black geese is equal to/the same as

the population mean weight of eggs from (her/the) white geese.

**OR**

H0: The population mean weight of eggs from (her/the) black geese is not less than

the population mean weight of eggs from (her/the) white geese.  
  
(b) 0.177

(c) fail to reject (the null)

Same test, number 7  
  
topic: Functions  
  
Mr. Brown observed that students have CRS … they just can’t remember much at all. He modelled the percentage of information they do remember, *R*, by the function where *t* is the number of days after a lesson.  
  
He found that 1 day after a lesson, student had forgotten 50% of the information presented.  
  
(a) Find the value of *p*. 2 points  
(b) Use the model to find the percentage of information retained by Mr. Brown’s students 36 hours after a lecture. 2 points

Based on his model, Mr. Brown believes that his students will always retain some information from the lecture.

(c) State a mathematical reason why Mr. Brown might believe this. 1 point

(d) Write down one possible limitation of the domain of this model. 1 point

Answer key:

1. 0.693
2. 35.4% or 35.4
3. *R*(*t*) > 0 **OR** *R*(*t*) has a horizontal asymptote

*Award* ***A1*** *for* ***one*** *reasonable limitation of the domain:* ***A1***

small values of *t* produce unrealistic results

*R*(0) =100%

large values of *t* are not possible

people do not live forever

model is not valid at small or large values of *t*

*The reason should focus on the domain t* ≥ 0 *. Do not accept answers such as:*

recollection varies for different people

memories are discrete not continuous

the nature of the information will change how easily it is recalled emotional/physical stress can affect recollection/concentration

Same test, #8. Topic: Number

Alex and LuisAlejandro each began a fitness program. One day, they both ran 500 meters. On each subsequent day Alex ran 100 meters more than the previous day. LuisAlejandro increased his distance by 2% of the distance ran on the previous day.

1. Calculate how far Alex ran on day 20 of his fitness program. 2 points
2. Calculate how far LuisAlejandro ran on day 20 of his fitness program. 3 point
3. On day *n* of the fitness programs LuisAlejandro runs more than Alex for the first time. Find the value of *n*. 3 points

Answer key

1. 2400 m (or 2400)
2. 728 m (or 728)
3. 185

Same test, number 9: Topic: Trigonometry

A triangular field ABC has side AB = 56 cm and BC = 82 cm. Each side is measured to the nearest centimeter. Angle B is 105°, measured to the nears 5°.  
  
(a) Calculate the maximum possible area of the field. 5 points

Answer key; 2280 cm2 or 2280

Same test, number 10. Topic: Probability  
  
A game is played where two unbiased dice are rolled and the score in the game is the greater of the two numbers shown. If the two numbers are the same, then the score in the game is the number shown on one of the dice.

Let *T* be the random variable “the score in a game”.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***t*** | 1 | 2 | 3 | 4 | 5 | 6 |
| **P(*T = t*)** | A | B | C | D | E | F |

1. What is the value of A?
2. What is the value of B?
3. What is the value of C?
4. What is the value of D?
5. What is the value of E?
6. What is the value of F? 2 points
7. Find the probability that a player scores at least 3 in a game. 1 point
8. Find the probability that a player scores 6, given they scored at least 3. 2 points.
9. Find the expected score of the game. 2 points

Answer key  
(a) 1/36 or 0.0279

(b) 3/36 or 1/12 or 0.0833

(c) 5/36 or 0.139

(d) 7/36 or 0.194

(e) 9/36 or ¼ or 0.25

(f) 11/36 or 0.306

(g) 32/36 or 8/9 or 0.889

(h) 11/32 or 0.344 or 34.4%

(i) 161/36 or 4.47

Number 11: Topic: Functions  
  
If an administrator is spotted near the classroom, a student will activate a siren to warn the students.  
  
The sound intensity, *I,* of the siren varies inversely with the square of the distance, *d*, from the siren, where *d* > 0.  
  
It is known that at a distance of 1.5 meters from the siren, the sound intensity is 4 watts per square meter (Wm-2).  
  
(a) Find the constant of variation 2 points

(b) While walking to a class, Fatima can hear the siren only if the sound intensity at her location is greater than Find the values of *d* where Fatima cannot hear the siren. 2 points

Answer key:

1. 9
2. 2450

Number 12: Topic: Calculus  
  
Ana designs a box, to hide things from Victoria. The top of the box is the shape of a right triangle, GIK.   
  
A rectangular section HIJL is inscribed in the triangle. The lengths of GH, JK, HL, and LJ are *p* cm, *q* cm, 8 cm, and 6 cm, respectively.  
  
The area of the top of the box is *A* cm2.  
  
(a) This is not a bot-friendly question, do it on paper: Find *A* in terms of *p* and *q.* 2 points.

(b) Do this on paper, too, bruh. Show that 2 points

(c) Find 2 points

(d) Ana wishes to find the value of *q* that will minimize the area of the top of the box (that protects her privacy from nosey Victoria). Write down the equation Ana could use to find this value of *q*. 1 point

(e) Find the value of *q*. 1 point  
  
Answer key:   
(a) *A* = × × *q* + × × *p* + ***OR***

1

( 6)( 8)

2 *A*

= *p* + *q* + ***OR***

*A* = 3*q* + 4 *p* + 48  
  
(b) shown on paper, cannot answer here

1. 3
2. -192/q^2 + 3 = 0
3. 8

Number 13, same test Topic: Calculus

Mr. Tacket takes golf practice. Each time he hits a ball he records the angle of the ball after being struck, and *l*, the horizontal distance the ball travels in meters when it first hits the ground.   
  
Mr. Tacket concludes that the following equation is super dope for this situation.

1. Determine if the graph of *l* against is increasing or decreasing at Just type increasing or decreasing. 3 points
2. Mr. Tacket observes that when the angle is 40°, the ball will travel a horizontal distance of 205.5 meters. Find an expression for the function Just type the right-hand side of the expression. Write (theta) for the symbol 5 points

Answer key:

1. Decreasing

-0.1(theta)^2 + 9(theta) +5.5   
  
Hint: recognition of need to integrate (e.g. reverse power rule or integral symbol or

1. integrating at least one term correctly)