Name: _____

Year 12 Mathematics Standard 2
Assessment Task 1

Budgeting and Household Expenses; Rates and Ratios; Bivariate Data		
Task Number: 1	**Weighting: 20%**	**Due Date: 27/11/20**

Outcomes assessed:

MS11-5	models relevant financial situations using appropriate tools
MS2-12-2	analyses representations of data in order to make inferences, predictions and draw conclusions
MS2-12-3	interprets the results of measurements and calculations and makes judgements about their reasonableness, including the degree of accuracy and the conversion of units where appropriate
MS2-12-7	solves problems requiring statistical processes, including the use of the normal distribution, and the correlation of bivariate data
MS2-12-10	uses mathematical argument and reasoning to evaluate conclusions, communicating a position clearly to others and justifying a response

Nature and description of the task:

As a result of completing this Assignment, students should be familiar with:

- interpreting about the costs from house bills, using a budget to purchase a motor vehicle, planning the purchase of a car, determining the cost of repayments and total amount repaid on a loan, describing the different types of motor vehicle insurance, calculating the cost of stamp duty on a vehicle, calculating the fuel consumption and running costs of a vehicle, preparing a personal budget for a given income, taking into account expenses.

- using rates to solve and describe practical problems, using rates to make comparisons, interpreting the energy rating of household appliances and compare running costs, solving practical problems involving ratios, using ratio to describe map scales, obtaining measurements from scale drawings, interpreting symbols and abbreviations on building plans and elevation views, calculating perimeter, area and volume using a scale from a variety of sources.

- constructing bivariate scatterplots to identify patterns in data, features and associations of bivariate datasets, identifying the dependent and independent variables, calculating and interpreting Pearson's correlation coefficient to quantify the strength of a linear association of a sample, modelling a linear association by fitting an appropriate line of best fit to a scatterplot and a least-squares regression line to the data, using an appropriate line of best fit to make predictions by either interpolation or extrapolation, implementing the statistical investigation.

On the 27th November 2020 you will receive a selection of questions similar to those in this preparation activity booklet. You will have 50 minutes (one period) to complete an in-class Validation Task. You are expected to investigate/attempt each of these questions before the in-class Validation Task. The final mark for this assessment will be the mark you receive on the in-class Validation Task only. Note: You will **NOT** have access to the Preparation Activity during the Validation Task. You do not have to submit the solutions to the preparation activity. You will **NOT** be given any answers to the Preparation Activity.

Non-Completion of Task:
If you know you are going to be away on the day the Assessment Task is due and are unable to hand in Assignment on the due day, then you must have supportive documentation. *Zero marks will apply if the Assessment Task is submitted/completed late, unless an Illness/ Misadventure or Application for Extension form has been submitted.*

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Preparation Activity

Section I - Multiple Choice

1. Gas bill increased by 5.8%. The previous bill was $680. What is the new gas bill correct to the nearest dollar?

   (A) $39
   (B) $394
   (C) $686
   (D) $719

2. Austin runs a 43.6 km marathon in 2 hours 50 minutes. What is his average speed?

   (A) 15 km/h
   (B) 16 km/h
   (C) 17 km/h
   (D) 18 km/h

3. What is the best description between living standards and life expectancy?

   (A) Zero correlation
   (B) Constant correlation
   (C) Negative correlation
   (D) Positive correlation

4. Dallas uses a 1.75-kilowatt per hour hairdryer for a total of 5 hours. He is charged at a rate of 16.72 cents per kilowatt-hour. What is the cost of using the hairdryer? Answer to the nearest cent.

   (A) $0.29
   (B) $1.46
   (C) $8.75
   (D) $146.30

5. Bella's maximum heart rate (MHR) is 192. Which of the following heart rates is within her targeted heart rate (65% - 85%).

   (A) 150
   (B) 170
   (C) 190
   (D) 210

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Section I (Continued)

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6. What is the correlation between the variables in the scatterplot?

   (A)   High Positive

   (B)   Low Positive

   (C)   High Negative

   (D)   Low Negative
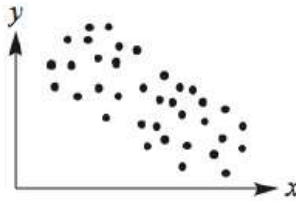
7. What is the total repayments on a car purchased for $63 800. Weekly repayments of $572 for 3 years.

   (A)   -2

   (B)   -1

   (C)   1

   (D)   2

8. Michelle uses a 600 W microwave for a total of 25 hours during the week. What is the cost of using the microwave for a week if electricity is $0.2248 per kWh?

   (A) $2.36

   (B) $3.37

   (C) $23.60

   (D) $33.72

9. Chloe's car uses 8 L of fuel to travel 25 km. How far can it travel on 20 L of fuel?

   (A)   6.25 km

   (B)   50 km

   (C)   60 km

   (D)   62.5 km

10. A used car with a sale price of $16 500 is purchased on a 25% deposit and weekly repayments of $130 for 4 years. What is the cost of purchasing the car?

   (A) $10 885

   (B) $16 500

   (C) $27 040

   (D) $31 165
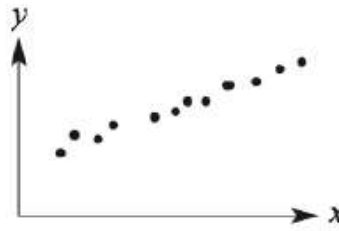
11. Ethan, Frank and George share a lottery prize in the ratio 2:3:4. If George's share is $5832, what is Frank's share?

   (A) $1458

   (B) $2916

   (C) $4374

   (D) $5832

Section I (Continued)

12. Which of the following best describes the correlation between x and y in the scatterplot shown?

(A)   High Positive

(B)   Low Positive

(C)   High Negative

(D)   Low Negative

13. Callum has been quoted $810 for comprehensive car insurance. He has a no claim bonus of 40%. How much is Callum required to pay?

(A) $324

(B) $486

(C) $1350

(D) $2025

14. The scale on a map is 1:1500. Calculate the actual distance if the distance on the map between points is 50cm. Express your answer in metres.

(A)   30 m

(B)   750 m

(C)   3000 m

(D)   75 000 m

15. Ava made a drink by mixing water with cordial in the ratio 5:2. What amount of water is required if she used 2.5 L of cordial?

(A)   2 L

(B)   2.5 L

(C)   5 L

(D)   6.25 L

16. A new SUV is bought for $40 850. What is the stamp duty payable if the charge is $5 per $200 or part $200?

(A) $1021.25

(B) $1025

(C) $2042.50

(D) $2050

Section I (Continued)

17. The height and weight of 8 men are given in the table below.

Height (in cm)	170	172	175	176	178	180	183	184
Weight (in kg)	62.3	60.9	70.2	74.9	80.9	77.2	85.9	86.1

What is the value of the Pearson's correlation coefficient?

(A) 0.8765

(B) 0.8814

(C) 0.9575

(D) 0.9873

18. What is the slope of the least-squares regression line given $r = 0.642, Sx = 2.567 \ and \ Sy = 5.123$?

(A) 0.23

(B) 0.32

(C) 1.14

(D) 1.28

19. Engine oil costs $65 for 5 litres. A car needs 5 litres of oil changed every 7500 km. Ian travels 30,000 km each year. What is the total cost of engine oil per year?

(A) $20

(B) $195

(C) $260

(D) $325

20. A medium sized car travelled 890 km using 70 L of petrol. What was the fuel consumption?

(A) $7.86 L/100 km

(B) $7.87 L/100 km

(C) $12.71 L/100 km

(D) $1271 L/100 km

21. What is the y-intercept of the least-squares regression line given $m = 0.83, \bar{x} = 50.67 \ and \ \bar{y} = 70.12$?

(A) -7.53

(B) 1.14

(C) 1.38

(D) 28.06

END OF SECTION I

Section II – Short Answer

22. Jason and his family received a yearly gas bill which outlined how much they were charged each month for the previous year. What percentage of the total cost was charged in the month of July?
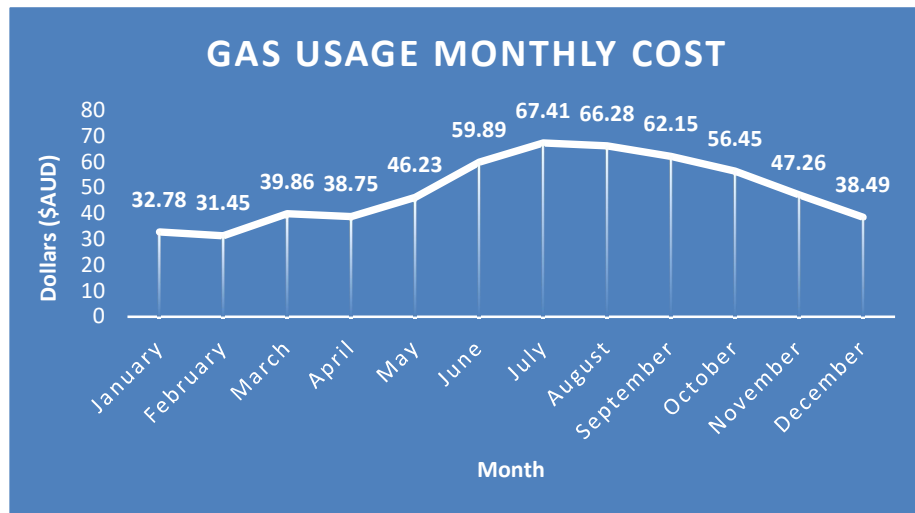
23. Brodie's share house has three people, including himself, living in it.

    The share house had their monthly electricity and gas bills arrive at the same time.

    The gas usage of the three people totalled 856.7 MJ and the electricity usage was 1549 kWh.

    If the price of gas is 1.319 cents per MJ and the price of electricity is $0.1978 per kilowatt-hour, how much would each tenant pay if bills were split evenly?

24. Keely has solar panels on the roof of her house that will typically produce 5987 W in 12 hours of sunlight.

    Keely is determined to export 10% of her solar energy production back into the grid which will decrease her electricity rate by 15.4%.

    (A) If Keely typically uses a total 103 kWh of electricity from solar panels and mains supply per day, how much electricity will she require from the grid, given that she exports 10% of her solar production?

    (B) What will the total cost of electricity be for Keely per day if electricity originally costs $0.19433 per kWh?

25. Bridgette purchased a small SUV for $31 990.

    She laid down a 20% deposit on the vehicle and was offered two finance options, one by the car dealership and one by the bank.

    The bank stipulates monthly repayments of $938.37 for 36 months while the dealership stipulates monthly repayments of $661.13 for 48 months.

    Which finance deal pays the least above the retail price and how much will it be?

Section II (Continued)

26. Emily is a mature aged student who works casually and studies full time.

Emily receives AusStudy support which amounts to $586 per fortnight and earns $225 per week working her casual job. (*Note: 1 month = 4 weeks for this exercise.*)

   (A) Emily has set herself a maximum rent amount of 25% of her weekly income. What is her budget for rent?

   (B) Emily has a typical weekly food spend of $110, monthly phone and internet bill of $120 and weekly fuel cost of $70.

   What is the remaining amount of money Emily has for utilities, entertainment and medical expenses?

   (C) Emily wants to save $1000 for a new TV.

   If her utilities are on average $340 per quarter and she doesn't spend money on medical or entertainment.

   How long will it take Emily to save for her new TV?

   (D) Is the timeframe Emily is expected to save the money for her TV realistic?

27. Jillian is 24 and has comprehensive car insurance for her vehicle.

Her premium is $1287.50 with a 25% no claim bonus.

The comprehensive insurance cost is set to decrease by 30% when she turns 25 and the no claim bonus will be increased to 40%.

   (A) What is the original cost of Jillian's comprehensive car insurance?

   (B) What is the cost of the comprehensive car insurance when Jillian turns 25 before the no claim bonus is applied?

   (C) What is the premium Jillian has to pay when she turns 25?

28. Jonathan is moving to Australia for three years and will require a car during this time.

He is deciding between whether to lease a vehicle or purchase a vehicle for the duration of his stay.

Using the figures shown, suggest which might be the best option for Jonathan and why.

This is given that he will be able to sell the vehicle at the end of the three years for 40% of its new price, if he decides to purchase one.

Costs	Leased Vehicle Costs Per Year	Purchased Vehicle Costs Per Year
Vehicle Repayments (0% interest)	$12 000	$7200
Maintenance	Included	$400
Fuel	Included	$3100
Comprehensive Insurance	Included	$954
Registration	Included	$833

Section II (Continued)

29. Luke is purchasing a new car from a dealership.

    They are running a deal on comprehensive car insurance if stamp duty is completed using their dealership.

    Stamp duty is 4% and the car will cost Luke $27 650.

    (A) Calculate the stamp duty Luke will have to pay.

    (B) Calculate the savings on comprehensive insurance, if it is 25% off and the original premium is $986.

    (C) Calculate the amount Luke must pay to the dealership in insurance and stamp duty.

30. Stephanie owns a sports hatchback and noticed that the fuel consumption of the vehicle is influenced by the pressure in her tyres.

    The pressure in her tyres decreases as temperature decreases.

    During Winter she has 28 psi in her tyres and fuel consumption is 10.2 L/100 km as opposed to Summer where she has 32 psi in her tyres and fuel consumption is 9.0 L/100 km.

    (A) Suggest a reason why fuel consumption may increase during winter?

    (B) If Stephanie drives 3200 km in winter and 5700 km in summer, and the average price of fuel during this time was $1.28, how much did she spend on petrol during winter and summer?

31. Sean can rap 165 words a minute. However, he must stop for approximately half a second after every line to take a breather as well as for coherency.

    (A) How many words are in a rap verse that lasts 20 seconds without any breaks?

    (B) Sean raps for 36.5 seconds, which includes 4.5 seconds of breaks. What is the average number of words in a line?

    (C) Each word has an average of 1.2 syllables. What is the average number of syllables in 6 seconds?

    (D) Sean raps 110 words with eight breaks. How long is his rap verse?

32. Towns A, B, C, and D are in a straight line. It takes a car 2 hours 36 minutes to get from town A to town C going at 105km/h.
    A bike would have to travel at 18km/h to reach the town D from town C in 24 minutes.

    (A) What is the distance between the towns A and D?

    (B) The train can travel that distance in an hour and a half. If the train takes 12 minutes to travel from town A to town B, what is the distance between town B and town C?

    (C) If building a train track costs $4500 per metre, how much does it cost to build a train track from town B to town D?

Section II (Continued)

33. While watching a horror movie, your average heart rate is around 92 bpm, whereas while watching an action movie that was 2 hours 25 minutes long, your heart beat 11 861 times.

    (A) How many times did your heart beat if the horror movie was 2 hours 12 minutes long?

    (B) What was your average heart rate while watching the action movie?

    (C) How long must you watch an action movie for your heart to beat the same amount as when you watch a horror movie that was 2 hours 8 minutes long? Answer correct to the nearest hours and minutes.

34. An energy company charges:

    (A) $0.22/kWh during peak hours, which are from 3pm to 9pm,

    (B) $0.20/kWh during the shoulder periods from 7am to 3pm and 9pm to 10pm, and

    (C) all other times of the day are counted as off-peak hours, which is charged at $0.18/kWh.

What is the ratio of the cost of using an appliance that uses 250 kWh from 5pm to 11pm and the cost of using the appliance that uses 300 kWh from 5am to 11am?

35. A group of students investigated on the capabilities of different fuel types.

    (A) A vehicle using unleaded petrol uses 4.62 litres of fuel when travelling at 112km/h for 45 minutes.
        If each litre of unleaded petrol costs $1.41, how much does it cost to travel 100km?

    (B) Another vehicle using diesel uses 6.0636 litres of fuel when travelling at 93km/h for an hour and 20 minutes.
        If each litre of diesel costs $1.49, how far must the vehicle travel for the cost of fuel to be the same as your answer in (A)?
        Answer correct to the nearest km.

36. An ice cream factory produces approximately 150 batches of ice cream daily, where each batch contains 25 two-litre tubs.

The following table shows some of the ingredients an ice cream factory uses to make 750 ml of cookies and cream ice cream.

Ingredients	Amount	Price
Cookies	16 pieces	$2.99 per 30 pieces
Heavy cream	400ml	$2.00 per 100 ml
Whole milk	200ml	$1.50 per litre
Sugar	125g	$0.15 per 100 g

    (A) What is the ratio of heavy cream in litres to every piece of cookie?

    (B) How much does the factory pay for milk in a week, given the factory works 7 days a week?

    (C) If $12 of sugar is used, how many cookies were used?

Section II (Continued)

37. Your city wishes to erect statues of some heroes in the middle of the park to commemorate their sacrifice.

   (A) One of the statues is to be 2.7 m tall. What scale should the sculptor use if the hero was 1.8 m tall?

   (B) The ratio of the shortest hero to the tallest in real life is 1:1.125. If the shortest hero was 1.63 m tall in real life, what is the difference in height between the statue of the shortest hero and the tallest hero in real life in centimetres?

38. You have been assigned the task of coming up with a blueprint for a new museum.

   The blueprint is to be split into three sections as follows.
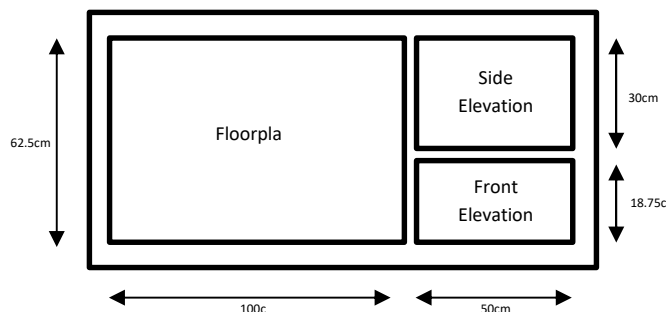
   The museum will have the length of 120m and a breadth of 75m.

   The highest point of the museum is 45m above the ground. The blueprint is shown below.

   (A) What would be a suitable scale for each section of the blueprint of the museum?

   (B) What is the ratio of the areas occupied by the three section of the blueprint?

39. A museum is open to the public from 6:00 a.m. to 12:00 a.m. daily except Sundays.

   There are guards stationed within the museum at all times in 2-hour shift rotations.

   The museum has a floor area of 26250 m^2.

   (A) If there are 20 guards stationed within the museum during each shift, each guarding the same amount of floor area, how much area is covered by 8 guards?

   (B) If each guard is required to work a total of 9 shifts each week, how many guards are there on the team?

40. The data below shows the cost of fuel (in cents per litre), and the average number of people on trains per day (in 000's).

Cost of Fuel	120	130	140	150	160	170
No. of Commuters	823	812	801	762	721	691

   (A) Construct a scatterplot using the data above.

   (B) Is there a relationship between the two variables?

   (C) What is the total drop-off in commuters as fuel prices rise from 120 to 170? What is the percentage decrease?

   (D) Calculate the mean number of commuters.

Section II (Continued)

41. The scatterplot shows the English and Mathematics results for 20 students.

(A) How many students do better in Mathematics than English?

(B) Is there any correlation between high English results and Mathematics results?

(C) What is the highest combined mathematics and English score?

Test Scores
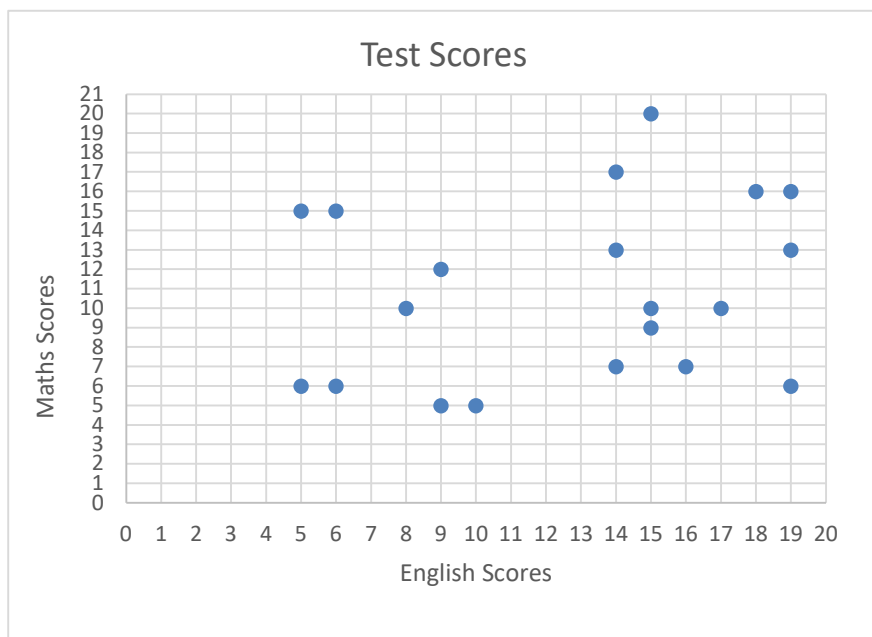
42. The table below depicts weight (kg) in comparison to height (m).

Height	1	1.2	1.4	1.6	1.8	2
Weight	31	42	54	63	73	82

(A) Draw a scatterplot using the above table.

(B) Describe the association between weight and height.

43. There is a high negative correlation between number of answers per question available on a multiple-choice test and the number of questions answered correctly.

(A) Explain why this correlation exists.

(B) What external factors might also explain this correlation?

44. The table below shows the number of rebounds per game for 10 people who play different amounts of minutes in a basketball game.

Minutes Played	4	8	12	16	20	24	28	32	36	40
Rebounds Grabbed	2	3	5	6	7	9	12	15	17	18

(A) Draw a scatterplot using minutes played as the horizontal axis and rebounds grabbed as the vertical axis.

(B) Find the equation of the least-squares line of best fit in terms of minutes played and rebounds grabbed.

(C) Use this equation to predict the number of rebounds grabbed when a player plays for 38 minutes.

(D) Use the equation to predict the minutes played if a player grabs 11 rebounds.

Section II (Continued)

45. You have been provided with the least-squares line of best fit by a data company on average time it takes for people to commute to work:

$$time = 0.8 \times distance + 31.2$$

Distance is measured by kilometers from CBD, and time is measured in hours.

(A) If the standard deviations of distance and time are 0.28 and 0.25 respectively, find the Pearson coefficient.

(B) Describe what the gradient means.

(C) Does this answer seem accurate?

46. A consultant gets paid in accordance to a least-squares regression line.

$$Income = 150 + 80 \times (Hours\ Worked)$$

Income is measured in dollars and the regression line can be applied for an eight-hour day.

(A) Describe what the numbers 150 and 80 represent.

(B) How many hours would the consultant have to work if his income is $570?

(C) If the consultant worked for 9 hours, what is his total income?

47. The table below depicts the findings of a study which investigated the effects of wages (in thousands $) on satisfaction levels.

Wages (000's)	30	35	40	45	50	55	60	65
Satisfaction Level (%)	20	22	34	42	54	62	68	75

(A) Using your calculator find the least-squares regression equation. Round the coefficients to two decimals.

(B) If an individual's wages increased from $30 000 to $75 000, how much would his satisfaction increase? Is this extrapolation or interpolation?

48. There is a strong positive correlation between the weight of a car and the litres per kilometre it consumes.

Why might this be true?

Does this imply that weight of a car causes the litres per kilometre to increase? If not, what other factors might influence the fuel consumption?

Section II (Continued)

49. The table shows the birth rate (live births per 1000) and the life expectancy (in years).

Birth rate (br)	30	38	40	43	34	42	31
Life Expectancy (le)	66	54	48	42	46	45	64

    (A) Draw a scatterplot using the above table.

    (B) State whether the association is positive or negative.

    (C) Describe the strength of the association as strong, moderate or weak.

    (D) Calculate the value of Pearson's correlation coefficient. Answer correct to four decimal places.

    (E) Determine the equation of the least-squares line of best fit.

    (F) Use the equation to predict the life expectancy when the birth rate is 35.

    (G) Use the equation to predict the birth rate when the life expectancy is 60.

End of Preparation Activity