Name $\qquad$ Teacher: $\qquad$

## 2020 Higher School Certificate Trial Examination

## Mathematics Standard 2

General
Instructions

- Reading Time: 10 minutes
- Working Time: 2 hours and 30 minutes
- Write using black pen
- Calculators approved by NESA may be used.
- A reference sheet is provided at the back of the paper
- For questions in Section II, show relevant mathematical reasoning and/or calculations

Total marks: $\quad$ Section I - 15 marks (pages 2-7)
100 - Attempt Questions 1-15

- Allow about 25 minutes for this section


## Section II - 85 marks (pages 9-33)

- Attempt Questions 16-43
- Allow about 2 hours and 5 minutes for this section


## Section I

## 15 marks

## Attempt Question 1-15

## Allow about 25 minutes for this section

Use the multiple-choice answer sheet for Questions 1-15.

1. Aiden earns an annual salary of $\$ 62400$. How much does Aiden earn each fortnight?
A. $\quad \$ 170$
B. $\$ 1200$
C. $\$ 2400$
$\$ 5200$
2. Which of the following is NOT an example of a quantitative continuous data type?
A. Height of buildings
B. Body Mass
C. Annual Rainfall
D) Shirt Sizes
3. In the following network, which vertex has the largest degree

(A.) A
C. C
D. D
4. The following is the graph of a relationship between two quantities $x$ and $y$.


What type of function would accurately model this data?
A. Hyperbola
B. Exponential
C. Quadratic
D. Cubic

* All Answers were
ACCEPTED

5. A dishwasher uses 40 litres of water per cycle. A family uses the dishwasher 7 times a week. If water costs $\$ 2.13$ per kilolitre, what is the annual water charge for this machine?
A. $\$ 2.08$
B. $\$ 31.01$
\$310.13
D. $\$ 596.40$
6. Jed measured the width of a football field to be 52.7 metres.

What is the percentage error of this measurement?
A. $\pm 0.05 \%$
B. $\pm 0.09 \%$
$\pm 0.5 \%$
D. $\pm 9.49 \%$
7. Hayden manufactures leather wallets. The following graph models the cost and income for his business.


Number of Wallets
Which of the following statements is incorrect?
A. Hayden's setup costs are $\$ 2000$
B. Once he has set up his business, each wallet costs $\$ 30$ to manufacture
C. He sells each wallet for $\$ 60$Hayden will make a profit if he manufactures 60 wallets
8. The three angles of a triangle are in the ratio of 1:2:3.

What is the size of the largest angle.
A. $30^{\circ}$
B. $60^{\circ}$
C. $90^{\circ}$
9. Joel earns $3 \%$ commission on every house he sells. If his commission this month was $\$ 9870$, what was the value of the property he sold?
A. $\quad \$ 296.10$
B. $\$ 10166.10$
C. $\$ 329000$
D. $\$ 615000$
10. Which of the following shaded regions show of $81.5 \%$ ?

A. Distribution P
B. Distribution Q
C. Distribution R
D. Distribution S
11. What is the coordinates $40^{\circ}$ South and $75^{\circ}$ West of the coordinates of $30^{\circ} \mathrm{N} 30^{\circ} \mathrm{W}$
A. $10^{\circ} \mathrm{S} 45^{\circ} \mathrm{W}$
B. $10^{\circ} \mathrm{S} 105^{\circ} \mathrm{W}$
$70^{\circ} \mathrm{N} 45^{\circ} \mathrm{W}$
D. $\quad 70^{\circ} \mathrm{N} 105^{\circ} \mathrm{W}$
12. In a science test, a class of 24 boys had a mean of 56 and a class of 16 girls had a mean of 66 .

What is the combined mean of the two classes?
A. 56
B. 60
D. 61
D. 62
13. The network below shows the roads connecting nine villages labelled A to I. The weights on the edges are the average travel times (in minutes) between adjacent villages.


What is the minimum travel time from B to H ?
A. 31 minutes
B. 33 minutes
C. 36 minutes
D. 37 minutes
14. Which of the following correctly expresses $x$ as the subject of $z=a b-a x^{2}$ ?
A.) $x= \pm \sqrt{\frac{a b-z}{a}}$

$$
z-a b=-a x^{2}
$$

B. $x= \pm \sqrt{\frac{z-a b}{a}}$

C. $x= \pm \frac{\sqrt{a b-z}}{a}$

D. $x= \pm \frac{\sqrt{z-a b}}{a}$

$$
x= \pm \sqrt{\frac{a b-2}{a}}
$$

15. The table below shows the activities and their prerequisites which make up a process.

| Activity | Immediate prerequisite(s) | Duration in days |
| :---: | :---: | :---: |
| Start | - | - |
| $C$ | - | 8 |
| $D$ | - | 9 |
| $E$ | $C$ | 9 |
| $F$ | $D$ | 8 |
| $G$ | $F$ | 5 |
| $H$ | $D$ | 6 |
| $I$ | $E . G$ | 8 |
| $J$ | $F$ | 7 |
| $K$ | $J, H$ | 9 |
| $E n d$ | $I, K$ | - |

Which diagram could represent this table?
A.

B.

C.

D.



Teacher: $\qquad$

Kirrawee High School

## 2020 Higher School Certificate Trial Examination

## MATHEMATICS STANDARD 2 Section II

85 marks<br>Attempt Questions 16-43<br>Allow about 2 hours and 5 minutes for this section

Instructions - Write your name and teachers name at the top of this page.

- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Your responses should include relevant mathematical reasoning and/or calculations.

Question 16 (2 marks)
Fletcher received a $60 \%$ discount as a "no claim bonus" on his car insurance. He paid $\$ 752$ to insure the car.

What would Fletcher have paid without the no claim bonus?

$\qquad$

Question 17 (2 marks)
Simplify $3(x+4)-2(x-1)$

$$
3 x+12-2 x+2
$$

$\qquad$ $x+14$
$\qquad$

Question 18 (2 marks)

Solve $\frac{x+2}{4}=3$

$$
x+2=12
$$

Question 19 (3 marks)
Eight employees at IGA Gymea earn the following wages per week:

$$
\begin{aligned}
& \$ 250, \$ 440,|\$ 470, \$ 540,| \$ 570, \$ 610, \$ 630, \$ 920 \\
& \text { le range. }
\end{aligned}
$$

a) Find the interquartile range.

b) Is the wage of $\$ 920$ an outlier for this data set?

Justify your answer with appropriate calculations.


Question 20 (3 marks)
Lukas takes out a reducing balance loan of $\$ 350000$ to purchase a unit. A loan repayment table is shown below. All values are in dollars.

| Month | Balance owing <br> at the beginning <br> of the month (P) | Interest $(\boldsymbol{I})$ | $\boldsymbol{P}+\boldsymbol{I}$ | Balance owing <br> at the end of <br> the month <br> $(\boldsymbol{P}+\boldsymbol{I}-\boldsymbol{R})$ |
| :---: | :---: | :---: | :---: | :---: |
| $\mathbf{1}$ | 350000.00 | 2100.00 | 352100.00 | 348800.00 |
| $\mathbf{2}$ | 348800.00 | 2092.80 | 350892.80 | A |
| $\mathbf{3}$ | 347592.80 | 2085.56 | 349678.36 | 346378.36 |
| $\mathbf{4}$ | 346378.36 | B | 348456.63 | 345156.63 |
| $\mathbf{5}$ | 345156.63 | 2070.94 | 347227.57 | 343927.57 |
| $\mathbf{6}$ | 343927.57 | 2063.57 | 345991.13 | 342691.13 |

a) Find the value for A and B in the table above.

b) What is his monthly repayment?
$\$ 352100-\$ 348800=\$ 3300$
$\qquad$
$\qquad$
$\qquad$

$$
(p+I)-(p+I-R)=\text { Monthly Repongat. }
$$

## Question 21 (2 marks)

The directed network below shows the maximum available capacity for transferring power to houses from sub-station ( P ) to ( T ) on a small island. The number on each edge represents the capacity in kilowatts (kW).


State the capacity of each cut in the diagram.
Cut $1=$..5.8.knu...........

Cut $2=\ldots .2$. K . . .........

## Question 22 (3 marks)

Kai purchases the following bosu ball in the shape of a closed hemisphere to help recovery from an injury sustained in a soccer game.


Calculate the surface area of this bose ball, correct to 2 decimal places.


## Question 23 (1 mark)

Convert $180 \mathrm{~km} / \mathrm{h}$ to $\mathrm{m} / \mathrm{s}$

$\qquad$
$\qquad$
$\qquad$

Question 24 (2 marks)
On $14^{\text {th }}$ January 2020, Kurt used his credit card to purchase a bottle of champagne and a bunch of roses for his girlfriend, valued at $\$ 199$. He made no other purchases on his credit card account in February. He paid the account in full on $13^{\text {th }}$ February 2020.

The credit card account has no interest free period. Compound interest is charged daily at a rate of $16 \%$ per annum, including the date of purchase and the date the account is paid.

How much interest, to the nearest cent did Kurt pay?


Question 25 (3 marks)
Molly has been selected for the Australian Women's Water Polo team to compete in the postponed 2021 Tokyo Olympics, in Japan, which is nine hours ahead of Coordinated Universal Time (UTC).

Kirralee will be studying at college in New York, USA which is five hours behind UTC.
a) Molly is going to ring Kirralee whilst walking in the Opening Ceremony at 10 pm on Friday night, Tokyo time. What day and time will it be in New York when she rings?

b) Molly's team make the Olympic Gold Medal game. Kirralee wants to surprise her and is going to fly from New York to Japan. Her flight will leave on Wednesday at 9 am, New York time, and will take 13 hours and 40 ming. What day and time will it be in Tokyo when she arrives?


Question 26 (5 marks)
The table below shows the lengths and weights of 8 babies at birth.

| Length $(L)(\mathrm{cm})$ | 49.2 | 48.8 | 48.8 | 49.7 | 49.4 | 49.1 | 49.5 | 49.4 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Weight $(W)(\mathrm{kg})$ | 3.28 | 3.18 | 3.32 | 3.21 | 3.35 | 3.28 | 3.37 | 3.23 |

a) Using the data, determine the correlation coefficient, correct to 4 significant figures.

$$
r=0.1351
$$

b) Describe the correlation between the length and weight of the babies.

c) Calculate the equation of the least squares line of best fit, in terms of $L$ and $W$
$\qquad$
$\qquad$
d) Calculate the weight $(W)$ of a baby born with a length of 50.4 cm .
$\qquad$

## Question 27 (4 marks)

A formula for estimating a females' blood alcohol content (BAC ) is given by:

$$
\text { BAC }(\text { female })=\frac{10 N-7.5 H}{5.5 M}
$$

Where :

- $N$ is the number of standard drinks consumed
- $H$ is the number of hours drinking
- $M$ is the person's mass ( kg )
a) Jessica has a mass of 54 kg and has been drinking alcohol for the last 3 hours at her hen's party.

Her BAC is now estimated to be 0.06

Show by rearranging the formula that Jessica has consumed 4 full standard drinks during this period of time.

b) One standard drink contains 10 grams of alcohol. Jessica's body can break down alcohol at the rate of 8.5 grams/hour.

If Jessica stops drinking alcohol now, after how many more hours and minutes (to the nearest minute) should Jessica's BAC be close to zero?


$$
\begin{aligned}
& \text { Th }+2 \mathrm{mrs}-3 h r s \\
&= 1 \text { hr } 42 \mathrm{rirs}
\end{aligned}
$$

Question 28 (4 marks)
The table shows the mean and standard deviation of the times (in seconds) swam in a 100 m freestyle race. The times are normally distributed.

|  | Mean | Standard Deviation |
| :--- | :---: | :---: |
| Female | 64.1 | 3.6 |
| Male | 61.8 | 5.8 |

a) Chloe swims the 100 m freestyle in 56.9 seconds.

What is Chloe's z-score?
$\qquad$
$\qquad$
$\qquad$
$z=-2$
b) Riley swims the 100 m freestyle in 56 seconds.

What percentage of males had a time slower than him?

2.w....................................................................................................................................................................................................................................................................
c) Which swimmer performed better in comparison to the other swimmers of their respective gender? Justify your answer.


Chlie=-2 so chloe performed bettor
$\qquad$

Question 29 (3 marks)
Alexis bought a new computer which was priced at $\$ 2300$. She paid a $\$ 500$ deposit and took out a loan from the store, paying monthly instalments of $\$ 84$ for 2 years.

How much did Alexis pay in total for the computer?
$\qquad$
$\qquad$
$\qquad$
$\qquad$

What simple interest rate per annum, to the nearest percent, was charged on the loan?

$$
\begin{aligned}
& \text { Intent }=\$ 2516-\$ 2300=\$ 216 \\
& \frac{I=-p e n}{\$ 26=\$ 1800 \times e \times 2} 1 \\
& e=\left(\frac{\$ 216}{\$ 1800 \times 2}\right) \times 100 \\
& R=6 \% \text { pa. }
\end{aligned}
$$

Question 30 (3 marks)
Sophia bought a car for $\$ 31600$. Her friend Eve said that all cars are worth nothing (ie the value is $\$ 0$ ) after 20 years.
a) Find the amount that the car would depreciate each year so that it will be worth nothing after 20 years, if the straight-line method of depreciation is used.

$$
\begin{aligned}
& 0=31600-D \times 20 \quad D=-31600 \\
& O=31600-20 D \\
& -31600=-20 D
\end{aligned}
$$

b) The value of car depreciates by $20 \%$ p.a. using the declining balance method of depreciation. In which year will the depreciated value first fall below $\$ 6600$ ?


## Question 31 (2 marks)

Cabins in a national park are to be connected to the power source at P . The weighted graph below shows the distance in metres of electrical cables between certain cabins and the power source ( $P$ ).


Using a minimum, a spanning tree, calculate the amount of cable in metres needed to power all cabins.
$10+12+12+9+12+15+28=98 m$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$

## Question 32 (4 marks)

The following network shows the time taken (in minutes) for Jordan to prepare for his surfing competition.

a) Complete the missing values for the EST (Earliest Starting Time) and LST (Latest Starting Time) in the network.
b) State the critical path for the network

$$
I-J-M-N-O-Q
$$

c) What is the float time for activity K?


## Question 33 (3 marks)

Ella intends to invest $\$ 5000$ for 2 years. She has two options:
A. investing at $6.4 \%$ pea. interest, compounded quarterly
B. investing at $6 \%$ pa. interest, compounded monthly.

Which is the better investment for her and by how much? Justify your answer with calculations.

$B \quad F V=5000\left(1+\frac{0.06}{12}\right)^{24}$
$=\$ .5635 .80$
$\$ \$ 677.01-\$ 5635.80=\$ 4121$ $\Rightarrow$ Optic $A ;$ bettor bog $\$ 14121$

Question 34 (2 marks)
The time taken to complete a journey varies inversely with the speed. A car takes 4 hours to complete a journey when travelling at $60 \mathrm{~km} / \mathrm{h}$.

Find the time taken to complete a journey if the car travels at $75 \mathrm{~km} / \mathrm{h}$.


Question 35 (4 marks)
Sasha and Amy hike 4.78 km due south from Grays Point to Dudley. They then hike 6.43 km on a bearing of $260^{\circ}$ to Loftus.
$\theta=360-260$

$$
=100^{\circ}
$$


a) Show that the distance from Loftus back to Grays Point is 8.65 km , correct to 2 decimals places.

$$
x=\sqrt{4.78^{2}+6.43^{2}-2 \times 4.78 \times 6.43 \times \operatorname{cor} 100}
$$

$$
x=805 \mathrm{~km}(2 d p) \cdots
$$

$\qquad$
$\qquad$
b) Calculate the bearing the girls needs to walk from Loftus back to Grays Point.

$\therefore$ Being for Lotus + C. CP is $047^{\circ}$

## Question 36 (3 marks)

The table below shows the future value of an annuity of $\$ 1$ for varying interest rates and time periods. Contributions are made at the beginning of each time period.

| $n$ | $1 \%$ | $2 \%$ | $3 \%$ | $4 \%$ | $5 \%$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 1.0100 | 1.0200 | 1.0300 | 1.0400 | 1.0500 |
| 2 | 2.0301 | 2.0604 | 2.0909 | 2.1216 | 2.1525 |
| 3 | 3.0604 | 3.1216 | 3.1836 | 3.2465 | 3.3101 |
| 4 | 4.1010 | 4.2040 | 4.3091 | 4.4163 | 4.5256 |
| 5 | 5.1520 | 5.3081 | 5.4684 | 5.6330 | 5.8019 |
| 6 | 6.2135 | 6.4343 | 6.6625 | 6.8983 | 7.1420 |
| 7 | 7.2857 | 7.5830 | 7.8923 | 8.2142 | 8.5491 |
| 8 | 8.3685 | 8.7546 | 9.1591 | 9.5828 | 10.0265 |
| 9 | 9.4622 | 9.9497 | 10.4639 | 11.0061 | 11.5779 |
| 10 | 10.5668 | 11.1687 | 11.8078 | 12.4864 | 13.2068 |
| 11 | 11.6825 | 12.4121 | 13.1920 | 14.0258 | 14.9171 |
| 12 | 12.8093 | 13.6803 | 14.6178 | 15.6268 | 16.7130 |

a) Natasha invests $\$ 500$ at the start of each year for 12 years at an interest rate of $5 \%$ pa.

Calculate the future value of Natasha's investment after 12 years.

$\qquad$
$\qquad$
b) Jack is planning to buy a new car in 3 years' time and he wants to save $\$ 8000$ in that time. He intends to make regular quarterly payments into an account that earns $8 \%$ pa. compounded quarterly.

What is the minimum quarterly payment into the account, to the nearest dollar, that Jack needs to make in order to have saved the $\$ 8000$ ?
Support your answer with calculations.

$$
8.000 \div 13.68 .03
$$


$\qquad$
$\qquad$

## Question 37 (3 marks)

The base of a water tank is in the shape of a square with semicircles on each side of the square. The side length of the square is 5 metres and the height of the water tank is 12 metres.

a) What is the capacity of the tank to the nearest kilolitre?
$V=$ Ret Prim +2 cylinders
$\sqrt{(=(5 \times 5 \times 12)}(\cdots)+(2 \times 11 \times 2.5 \times 12)$

$C=771.24 \mathrm{~kL}$
$\therefore$ capacity $=771 \mathrm{~kL}$

Question 38 (4 marks)
Bella has earned a gross salary of \$102500 in 2019-2020. Throughout the year, she has made regular PAYG tax payments, totaling \$27500.

She has calculated she has the following allowable taxable deductions:

- Work related travel - \$1280
- Stationary - \$350
- Professional subscriptions - $\$ 450$

Bella must also pay the Medicare levy of $2.5 \%$ of her taxable income.
Using the tax table provided below, determine Bella's tax refund or tax debt.

| Taxable income | Tax on this income |
| :--- | :--- |
| $0-\$ 18,200$ | Nil |
| $\$ 18,201-\$ 37,000$ | $19 c$ for each $\$ 1$ over $\$ 18,200$ |
| $\$ 37,001-\$ 80,000$ | $\$ 3,572$ plus $32.5 c$ for each $\$ 1$ over $\$ 37,000$ |
| $\$ 80,001-\$ 180,000$ | $\$ 17,547$ plus 37 c for each $\$ 1$ over $\$ 80,000$ |
| $\$ 180,001$ and over | $\$ 54,547$ plus 45 c for each $\$ 1$ over $\$ 180,000$ |



$$
\begin{aligned}
\therefore \text { Tar Debt } & =\$ 27812.90-725000 \\
& =\$ 12.90
\end{aligned}
$$

## Question 39 (3 marks)

A plane flying at an altitude of 1500 m . At exactly 2 pm , the pilot notices a town which is at an angle of depression of $7^{\circ}$. Two minutes later, the same town is at an angle of depression of $11^{\circ}$.


Town
a) Calculate the straight-line distance $d$, between the plane and the town at 2 pm . Give your answer to the nearest metre.
$\cos 83^{\circ}=\frac{1500}{2}$
$a=\frac{1500}{68}$
$0,=12308.26 m$ $=12308 \mathrm{~m}$
b) Calculate the distance the plane has flown between 2 pm and 2:02 pm to the nearest metre.


## Question 40 (3 marks)

The diagram shows the flow of water in $\mathrm{kL} /$ minute from the $\operatorname{sink}(\mathrm{D})$, through pipes to a series of filtration stations ( $\mathrm{W}, \mathrm{X}, \mathrm{Y}$ and Z ) and on to the source (R).


The weights on each edge represents the capacity in kilolitres of each pipe.
a) What is the maximum flow from the source (D) to the sink (R)?
$D Y R=11$
$D \times Y R=7$ MAX FLOW $=35 \mathrm{~kL} / \mathrm{mm}$
$D \times R=2$
$D W \times R=7$
$D W \times Z R=1$
$D W Z R=7$
b) What is the excess capacity of the pipe DW?
$\qquad$

## Question 41 (5 marks)

The probability of rain for the next three days is shown in the table below.

|  | Probability of rain |
| :--- | :---: |
| Day 1 | 0.25 |
| Day 2 | 0.55 |
| Day 3 | 0.20 |

a) Complete the probability tree diagram below for the information in the above table.

## Day 1

Day 2
Day 3

b) Calculate the probability that there is no rain for the three days

$$
.0 .75 \times 0.55 \times 0.8=0.27 \text { ar } 27 / 100
$$

c) Calculate the probability that there will be rain for exactly two days.
$(0.25 \times 0.55 \times 0.8)+(0.75 \times 0.55 \times 0.2)+(0.25 \times 0.45 \times 0.2)$
$=0.215$
$\qquad$
$\qquad$

## Question 42 (3 marks)

A $\$ 200000$ loan at $6.7 \%$ pa. reducible interest can be repaid by making either monthly or fortnightly repayments. The graph shows the loan balances over time using these two different methods of repayment.


The overall monthly repayment is $\$ 2000$ and the fortnightly repayment is $\$ 1000$.
What is the difference in the total interest paid using the two different methods of repayment, to the nearest dollar?

$$
\text { Fortnightly }=26 \times 24 \times 1000=\$ 624000
$$

Mouth li $=12 \times 30 \times 2000=\$ 720000$
$\cdots \quad \$ 720000 \div \$ 624000$
$\qquad$
$\qquad$
$\qquad$

## Question 43 (5 marks)

In order to find the area of a lake which was surrounded by grass, Holly took some measurements (in metres) and drew the following diagram.

a) Use the Trapezoidal Rule to find the area of the grass that surrounds the lake

## $=81000 \mathrm{~m}^{2}$

b) Calculate the area of the lake.
$(600 \times 200)-81000 m^{2}=39000 \mathrm{~m}^{2}$
c) If the lake can hold 47.7 ML of water, calculate the depth of the lake.


## If you have spare time, go back and check all your answers and retype your calculations into your calculator.

## Section II extra writing space

If you use this space, clearly indicate which question you are answering.

## Section II extra writing space

If you use this space, clearly indicate which question you are answering.

Student: $\qquad$

Teacher: $\qquad$

## Kirrawee High School Mathematics Standard 2

## Trial Examination 2020

## Section I-15 marks

## Attempt Questions 1-15

Select the alternative $A, B, C$, or $D$ that best answers the question. Fill in the response oval completely.

## Sample: $2+4=$



If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.


If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word correct and drawing an arrow as follows.
A



1.
.

9.


B


D $\bigcirc$
2.

10. $\mathrm{A} \bigcirc$


D $\bigcirc$
3. A

$c \bigcirc$
D $\bigcirc$
11. A


B

C $\bigcirc$
D
4. A
 B
$c \bigcirc$ D $\bigcirc$

12


B

C $\bigcirc$
D
5. A $\qquad$ B C $\bigcirc$ D O

13

14
4. A
 B

C

15. A

8


B$C D$ D

 B$c \bigcirc$
 D $\bigcirc$

