Student Number:



# Ascham School

# **Year 12 Mathematics Standard 2**

# TRIAL EXAMINATION

Date: 2 August 2019 Time: 2<sup>1</sup>/<sub>2</sub> hours

## **General Instructions**

- Reading time 10 minutes.
- Working time  $-2\frac{1}{2}$  hours.
- Write using black pen.
- Approved calculators may be used.
- A formulae sheet is provided.

## Result

Total marks - 100

## Section I 15 Marks

- Attempt Questions 1-15.
- Allow about 25 minutes for this section.
- Record your answers on the multiple choice answer sheet.

## Section II 85 Marks

- Attempt Questions 16-21.
- Allow about 2 hours 5 minutes for this section.
- Answer in the space provided.

# Section I – Multiple Choice Answer Sheet

1	$_{\rm A}$ $\bigcirc$	в	С	D 🔾
2	$A \bigcirc$	В 🔿	С 〇	$D \bigcirc$
3	$A \bigcirc$	В 🔿	С 〇	$D \bigcirc$
4	A 🔿	В 🔿	С 〇	$\mathtt{D}\bigcirc$
5	A 🔿	В 🔿	С 🔿	D 🔿
6	A 🔿	В 🔿	С 🔾	$D \bigcirc$
7	A 🔿	В 🔿	С 🔾	D 🔾
8	A 🔿	в 🔿	С 〇	$\mathtt{D}\bigcirc$
9	A 🔿	В 🔿	С 🔾	$D \bigcirc$
10	A 🔿	В 🔿	С 🔾	$D \bigcirc$
11	A 🔿	В 🔿	С 〇	$D \bigcirc$
12	A 🔿	В 🔿	С 🔾	$D \bigcirc$
13	A 🔿	В 🔿	С	D 🔿
14	A 🔿	В 🔿	С 🔾	$D \bigcirc$
15	A 🔿	В 🔿	СО	D 🔿

# **Section I**

15 marks Attempt Questions 1-15 Allow about 25 minutes for this section Use the multiple-choice answer sheet for Questions 1-15.



1 Which statement is true for the given triangle?



The results of Mathematics exam were normally distributed.
 Betty gained a *z*-score of -2.
 What percentage of students scored better than Betty?

(A) 84% (B) 97.5%



3 Which line below has the equation y=4-3x?

4 The equation of the graph below is:



5 Grant wins \$500 and invests it 4 years at 8% p.a. interest compunded quarterly. To calculate the amount of interest earned on the investment, Grant would use:

(A) 
$$500 \times 1.02^{16} - 500$$
(B)  $500 \times 0.8 \times 4$ (C)  $500 \times (1+0.02)^{16}$ (D)  $500 \times 1.08^4 - 500$ 

**6** Which of the following is the spanning tree of the network below?



7 What is the compass bearing of *P* from *O*?



8 Which of the following is the fastest speed?

- (A) 20 m/s (B) 60 km/h
- (C) 100 m/min (D) 25 000 m/h

9 A ship sails a distance of 50 km on a bearing of 040°.Which expression can be used to find how far east the ship travelled?



10 For the network below, *BADCBEA* represents:



11 If it is 10:35 am in Vancouver (UTC -8) what is the local time in Paris (UTC +1)?
(A) 1:35 am
(B) 5:35 pm

(C) 3:35 am (D) 7:35 pm

- **12** Convert 8.5  $m^2$  to  $cm^2$ ?
  - (A) 85 (B) 8 500
  - (C) 850 (D) 85 000
- **13** The Whitney Hotel in London offers the following menu options for its Christmas Lunch.



How many 3-course selections are possible?

(A) 3	<b>(B)</b> 24
(C) 10	<b>(D)</b> 36

- 14 What is the effect of a 40% increase, followed by a 40% decrease on a sum of money?
  - (A) An overall increase on the original amount.
  - (B) An overall decrease on the original amount.
  - (C) No change to the original amount.
  - (D) Not enough information has been provided.
- 15 Rachel measures the length of a window to be 250 cm, correct to the nearest centimetre. What is the percentage error in her measurement?

(A) $\pm 0.002\%$	(B) $\pm 0.004\%$

(C)  $\pm 0.2\%$  (D)  $\pm 0.4\%$ 

# **End of Section I**

# **Section II**

85 marks Attempt all questions Allow about 2 hours and 5 minutes for this section Answer each question in the space provided. Show all relevant working in questions involving calculations. Additional writing space is available at the back of this booklet.

## **Question 16** (15 marks)

a) Allison uses a dishwasher with a rating of 800 W for 2.5 hours each day. Find [2] the daily cost of electricity for using the dishwasher if electricity is charged at a rate of 21.40 cents per kWh.

**b)** Maddie and Annie made a seesaw as per diagram below. It is known that the weight of a person, w, varies inversely to the distance of a person to the middle of the seesaw, d.

The equation  $w = \frac{k}{d}$ , where k is a constant, models this situation.



i) Given that Maddie weighs 65 kg and is sitting 1.20m away from the middle [2] of the seesaw, find the value of the constant, k and state the equation of the relationship.



**d)** Monique purchased new appliances after renovating her home. The appliances depreciate at a rate of 15% per annum. After the three years, the appliances are worth \$19 770.

What was the original purchase price of the appliances? Give your answer [2] correct to the nearest dollar.

e) There are 2 480 phone numbers on a list. Every 8<sup>th</sup> number is phoned.

 What type of sampling is this?
 [1]

**End of Question 16** 

## **Question 17** (15 marks)

a) A three-digit number is made up of the digits 4, 5 and 8. If the digits are not repeated, what is the probability that the number:

**b)** Given  $BAC_{MALE} = \frac{10N - 7.5H}{6.8M}$  calculate the *BAC* for a 95 kilogram male who has consumed 3 standard drinks between 7 pm and 9.30 pm. [1] Mel leaves Darwin (UTC +9.5) at 1.40 pm on Monday and arrives in Singapore c) (UTC +8) at 4.50 pm on Monday. How long is Mel's direct flight from Darwin to Singapore? [2]

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
0.1	.53983	.54380	.54776	.55172	.55567	.55966	.56360	.56749	.57142	.57535
0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91308	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408

**d)** For a data set that is normally distributed and *z* is the standardised score, find the following using the table of standard normal distribution below:

i) P(z > 1.43)



[2]

ii) What is the probability that a randomly chosen score has a *z*-score that falls into the shaded areas on the diagram below?



e) Consider the diagram below.



i)	Use the cosine rule to show that $\theta = 128^{\circ}$ , correct to the nearest degree.	[0]
		[2]
ii)	What is the angle of elevation of $B$ from $D$ .	[1]
iii)	Find the bearing of $D$ from $B$ .	60
iv)	Find the length of $AC$ , correct to one decimal place.	[2]
		[4]
	End of Question 17	

## **Question 18** (15 marks)

a) The side of the square base of one of the smaller pyramids in Giza has length of 1.4 cm on the map.



The scale used is 1:15000. What is the actual length of the side of the pyramid's base in metres? i) [1] ii) Each side of the pyramid forms [2] an isosceles triangle as per diagram on the right. Find the actual length of the slant 52° edge of the pyramid. iii) The ratio of base edges of the [2] smaller to larger pyramids are in the ratio 7:13. Find the area of the square base of the larger pyramid.

**b)** The volume of a sphere is 4988.92 cm<sup>3</sup>. Find, correct to 1 decimal place, the sphere's:



c) i) Use the Trapezoidal rule to estimate the area of the reservoir in the diagram below. Answer correct to the nearest square metre. [2]





Period		Interest rate per period								
	2%	2.5%	3%	3.5%	4%	4.5%	5%	5.5%	6%	8%
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0200	2.0250	2.0300	2.0350	2.0400	2.0450	2.0500	2.0550	2.0600	2.0800
3	3.0604	3.0756	3.0909	3.1062	3.1216	3.1370	3.1525	3.1680	3.1836	3.2464
4	4.1216	4.1525	4.1836	4.2149	4.2465	4.2782	4.3101	4.3423	4.3746	4.5061
5	5.2040	5.2563	5.3091	5.3625	5.4163	5.4707	5.5256	5.5811	5.6371	5.8666
6	6.3081	6.3877	6.4684	6.5502	6.6330	6.7169	6.8019	6.8881	6.9753	7.3359
7	7.4343	7.5474	7.6625	7.7794	7.8983	8.0192	8.1420	8.2669	8.3938	8.9228
8	8.5830	8.7361	8.8923	9.0517	9.2142	9.3800	9.5491	9.7216	9.8975	10.6366
9	9.7546	9.9545	10.1591	10.3685	10.5828	10.8021	11.0266	11.2563	11.4913	12.4876
10	10.9497	11.2034	11.4639	11.7314	12.0061	12.2882	12.5779	12.8754	13.1808	14.4866
11	12.1687	12.4835	12.8078	13.1420	13.4864	13.8412	14.2068	14.5835	14.9716	16.6455
12	13.4121	13.7956	14.1920	14.6020	15.0258	15.4640	15.9171	16.3856	16.8699	18.9771
15	17.2934	17.9319	18.5989	19.2957	20.0236	20.7841	21.5786	22.4087	23.2760	27.1521
18	21.4123	22.3863	23.4144	24.4997	25.6454	26.8551	28.1324	29.4812	30.9057	37.4502
20	24.2974	25.5447	26.8704	28.2797	29.7781	31.3714	33.0660	34.8683	36.7856	45.7620

d) The table below shows the future value of an annuity with a contribution of \$1.

i) Angela is saving for a holiday by contributing \$500 into an annuity that pays interest at the rate of 8% p.a., compounded quarterly. Use the table above to find how much she will have in 2 years' time.



### End of Question 18

# **<u>Question 19</u>** (15 marks)

yiel	yield of 15% and brokerage of 3%.								
<u>Op</u> divi	<b>tion 2:</b> 1000 shares which have a market price of \$3.45 each and paidend of 32 cents per share. Brokerage is 2.5%.								
i)	Which option will cost less in terms of brokerage?								
ii)	Which option is cheaper in terms of total cost of purchasing shares?								
iii)	Belinda chose Option 2. Find her expected dividend yield.								
iv)	Belinda suddenly needs to cash in her shares. She managed to sell them a								
	Did she made a profit or loss with this sale? Calculate this amount.								

**b)** The table below is used to represent a network.

			ТО					
		Р	Q	R	S	Τ		
	P	-	9	-	25	15		
Σ	Q	9	-	5	12	20		
S.	R	-	5	-	30	3		
E	S	25	12	30	-	35		
	Τ	15	20	3	35	-		

i)	Find the minimum spanning tree. Additional space provided on the next page.	


c) Tilly owns a car which she uses both in the city and in the country.

The fuel consumption rate in the city is 10.5L/100 km.

When she was last in the country, she used 28L of petrol and travelled 350 kilometres.

	i)	Show that the fuel consumption rate in the country is 8L/100km.	[1]
ii)	Last y How	year, Tilly drove 14 000 km in the city and 20 000 km in the country. much fuel did she use in total?	[2]
iii)	Tilly She i much fuel?	spends an average of \$4 500 on fuel per year. Is considering switching to a cheaper fuel that costs \$1.30/L. How is money she would have saved last year if she had used this cheaper	[2]
		End of Auestian 19	
		C. Known r.	

## **Question 20** (15 marks)

The cost of catering is related to the number of people attending an event, as a) per table below. Number of people - *n* 5 10 15 20 25 30 35 40 45 50 Cost - C 143 175 204 65 92 110 119 162 190 240 Find, correct to 4 decimal places, Pearson's correlation coefficient, r. i) [1] ii) Calculate the mean and standard deviation of the number of people,  $\bar{x}_{i}$ and  $\sigma_n$ . Give your answers correct to 2 decimal places. [1] iii) Calculate the mean and standard deviation of the cost,  $\bar{x}_{c}$  and  $\sigma_{c}$ , correct to 2 decimal places. [1] iv) Show that the equation of the least-squares line of best fit is given by C = 3.57n + 51.83. [2] v) Use the equation to calculate the cost of catering for a hundred people. [1] **b)** A speed camera on the road in outback records car speeds and the results are normally distributed with mean speed of 65 km/h and standard deviation of 15 km/h.

Complete the diagram below by entering the appropriate values in the red boxes.



## Standard normal distribution table

(										
Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
0.1	.53983	.54380	.54776	.55172	.55567	.55966	.56360	.56749	.57142	.57535
0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91308	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
3.0	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900
3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950
3.3	.99952	.99953	.99955	.99957	.99958	.99960	.99961	.99962	.99964	.99965
3.4	.99966	.99968	.99969	.99970	.99971	.99972	.99973	.99974	.99975	.99976
3.5	.99977	.99978	.99978	.99979	.99980	.99981	.99981	.99982	.99983	.99983
3.6	.99984	.99985	.99985	.99986	.99986	.99987	.99987	.99988	.99988	.99989
3.7	.99989	.99990	.99990	.99990	.99991	.99991	.99992	.99992	.99992	.99992
3.8	.99993	.99993	.99993	.99994	.99994	.99994	.99994	.99995	.99995	.99995
3.9	.99995	.99995	.99996	.99996	.99996	.99996	.99996	.99996	.99997	.99997

c) Ella is considering options for a personal loan of \$50 000.

**Option 1:** The graph shows the amount owing on her personal loan over a period of time and monthly repayments.



[4]



Term in	7%	7.25%	7.5%	7.75%	8%	8.25%	8.5%
years							
5	\$19.8012	\$19.9194	\$20.0379	\$20.1570	\$20.2765	\$20.3963	\$20.5164
10	\$11.6108	\$11.7401	\$11.8702	\$12.0011	\$12.1328	\$12.2653	\$12.3985
15	\$8.9883	\$9.1286	\$9.2701	\$9.4128	\$9.5566	\$9.7014	\$9.8474
20	\$7.7530	\$7.9036	\$8.0559	\$8.2095	\$8.3644	\$8.5207	\$8.6782
25	\$7.0678	\$7.2281	\$7.3899	\$7.5533	\$7.7182	\$7.8875	\$8.0522
30	\$6.6530	\$6.8218	\$6.9921	\$7.1641	\$7.3377	\$7.5127	\$7.6891

Monthly repayment per \$1000 borrowed

Find which option is better for Ella by considering the total amount of interest charged and the total Ella can save over the term of the loan.


### End of Question 20

#### **<u>Question 21</u>** (10 marks)

Future value of an annuity

 $FV = a \left\{ \frac{(1+r)^n - 1}{r} \right\}$ 

a)

Sophie wishes to purchase a holiday home at a price of \$340 000. She has a deposit of \$70 000. She will take the loan over 25 years at 9.6% p.a. compounding monthly. For the first 5 years she wishes to reduce her expenses by making interest only repayments. i) Find Sophie's monthly repayment for the first five years of the loan period. [2] ii) Find Sophie's monthly repayment for the remaining loan period. [2] iii) Calculate the total amount of interest Sophie pays over the loan period. [2]

Present value of an annuity

 $PV = a \left\{ \frac{(1+r)^n - 1}{r(1+r)^n} \right\}$ 

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b) The annual interest rate on a credit card is 21.5% p.a. There is an interest-free period of 55 days for purchases and a 1.5% fee for cash advances (added on at the end of the month).

Assume there is no interest-free period remaining on the opening balance.

March Statement			
Date	Details	Amount (\$)	
1 Mar	Opening balance	450	
7 Mar	Purchase	230	
12 Mar	Cash advance	100	
20 Mar	Payment	- 500	
25 Mar	Purchase	350	

Calculate the balance on this credit card at the end of March.

[4]



# **END OF EXAMINATION**

# Extra writing space

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

-----\_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_  \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ ------\_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ 



NSW Education Standards Authority

2019 HIGHER SCHOOL CERTIFICATE EXAMINATION

# Mathematics Standard 1 Mathematics Standard 2

### REFERENCE SHEET

#### Measurement

#### Limits of accuracy

Absolute error  $=\frac{1}{2} \times \text{precision}$ Upper bound = measurement + absolute error Lower bound = measurement – absolute error

#### Length

 $l = \frac{\theta}{360} \times 2\pi r$ 

Area

$$A = \frac{\theta}{360} \times \pi r^2$$
$$A = \frac{h}{2} (a + b)$$
$$A \approx \frac{h}{2} (d_f + d_l)$$

Surface area  $A = 2\pi r^2 + 2\pi rh$   $A = 4\pi r^2$ Volume  $V = \frac{1}{3}Ah$  $V = \frac{4}{3}\pi r^3$ 

#### Trigonometry

$$\sin A = \frac{\text{opp}}{\text{hyp}}, \quad \cos A = \frac{\text{adj}}{\text{hyp}}, \quad \tan A = \frac{\text{opp}}{\text{adj}}$$
$$A = \frac{1}{2}ab\sin C$$
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$
$$c^2 = a^2 + b^2 - 2ab\cos C$$
$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

#### **Financial Mathematics**

 $FV = PV(1+r)^n$ 

Straight-line method of depreciation

$$S = V_0 - Dn$$

Declining-balance method of depreciation

$$S = V_0 (1 - r)^n$$

### **Statistical Analysis**

An outlier is a score less than  $Q_1 - 1.5 \times IQR$  or more than  $Q_3 + 1.5 \times IQR$ 

$$z = \frac{x - \overline{x}}{s}$$

#### Normal distribution



- approximately 95% of scores have z-scores between -2 and 2
- approximately 99.7% of scores have z-scores between –3 and 3