

南洋女子中学校 NANYANG GIRLS' HIGH SCHOOL

End-Of-Year Examination 2020 Secondary 4

ADVANCED MATHEMATICS

1 hour

Tuesday

6 October 2020

1215 - 1315

READ THESE INSTRUCTIONS FIRST

- 1. Write your name, register number and class on all the work you hand in.
- 2. Answer all questions.
- 3. Write your answers and working on the separate writing paper provided, unless otherwise stated.
- 4. Write in dark blue or black ink on both sides of the paper.
- 5. You may use an HB pencil for any diagrams or graphs.
- 6. Do not use staples, paper clips, glue or correction tape/fluid.
- 7. Omission of essential working will result in loss of marks.
- 8. The use of an electronic calculator is expected, where appropriate.
- 9. If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142, unless the question requires the answer in terms of π .

- 10. At the end of the examination, fasten all your work securely together.
- 11. The number of marks is given in brackets [] at the end of each question or part question.
- 12. The total number of marks for this paper is 40.

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1	Expa	Expand $(4+2x)^{-\frac{1}{2}}$ as a series of descending powers of x up to and including the term				
	in x	$\frac{7}{2}$ and	state the range of values of x for which the expansion is valid.	[4]		
2	There	e are 5	male and 4 female job applicants waiting for their turn in a job interview	V.		
	Two	particu	alar males are Andy and Ben, and one particular female is Mandy. They	sit		
	in a row of 9 seats in the waiting room. Find the number of ways of arranging them in					
	each	of the	following cases:			
	(i)	ther	e is no restriction,	[1]		
	(ii)	Mar	ndy occupies the centre seat with Andy on her left and Ben on her right			
		(nee	ed not be adjacent),	[2]		
	(iii)	the f	female and male applicants alternate.	[2]		
3	(a)	The sum of the first three terms of an arithmetic progression is 45 and				
		the 40 th term of the progression is 91. Find				
		(i)	the first term of the series and the common difference,	[3]		
		(ii)	the sum of the terms from the 15^{th} to the 100^{th} terms.	[2]		
	(b)	In a	geometric progression, the first term is 8 and the sixth term is $-\frac{1}{4}$. Find			
		(i)	the sum S_n of the first <i>n</i> terms of the progression,	[2]		
		(ii)	the sum to infinity S of the progression,	[1]		
		(iii)	the smallest prime number <i>n</i> such that $ S_n - S < 0.01$.	[2]		
4	Find	the equ	uation of the normal to the curve $xy + y^2 = 2x$ at the point $(1, -2)$.	[6]		

5 (a) Find
$$\int \sqrt[3]{x} \ln x \, dx$$
. [4]

(b) Evaluate
$$\int_{0}^{3} 3x\sqrt{1+4x^2} \, dx$$
. [4]

- 6 Find the volume generated when the area bounded by the curve $y = \ln x$ and the lines y = 1 and x = 1 is rotated through one revolution about the *y*-axis. Give your answer in exact form. [3]
- 7 An insurance agent spends a period of successive days selling a particular insurance policy to his clients. If he manages to sell the policy on any given day, the probability that he successfully sells the policy on the following day is 0.8. If he fails to sell the policy on any given day, the probability of success on the next day is 0.3. If he successfully sells a policy on Tuesday, calculate the probability that
 - (i) he successfully sells a policy on Thursday, [2]
 - (ii) he successfully sells a policy on Friday, given that he did not manage to sell it on Wednesday.

END OF PAPER

Answer Key

1	$\frac{1}{\sqrt{2}}x^{-\frac{1}{2}} - \frac{1}{\sqrt{2}}x^{-\frac{3}{2}} + \frac{3}{2\sqrt{2}}x^{-\frac{5}{2}} - \frac{5}{2\sqrt{2}}x^{-\frac{7}{2}} + \dots$
	The expansion is valid for $ x > 2$.
2i	9! =362880
2ii	$1 \times 4 \times 4 \times 6! = 11520$
2iii	$5! \times 4! = 2880$
3ai	So the first term is $a = 13$ and the difference is $d = 2$.
3aii	Sum of terms = 10836
3bi	$S_{n} = \frac{16}{3} \left(1 - \left(-\frac{1}{2} \right)^{n} \right)$
3bii	$S = \frac{16}{3}$
3biii	The smallest prime value of <i>n</i> is 11.
4	$y = \frac{3}{4}x - \frac{11}{4}$
5a	$\frac{3}{4}x^{\frac{4}{3}}\ln x - \frac{9}{16}x^{\frac{4}{3}} + c, c \text{ is arbitrary constant}$
5b	$\frac{1}{4} \left[37^{\frac{3}{2}} - 1 \right]$
6	$\frac{\pi(e^2-3)}{2}$ cubic units
7i	0.7
7ii	0.45