

新民中学 SEKOLAH MENENGAH XINMIN

XINMIN SECONDARY SCHOOL

Preliminary Examination 2022

CANDIDATE NAME

CLASS

INDEX NUMBER

MATHEMATICS

Secondary 4 Express/5 Normal

Setter: Mrs Susan Ng Vetter: Ms Low Yan Jin Moderator: Ms Yap Bee Leng

Candidates answer on the Question Paper

READ THESE INSTRUCTIONS FIRST

Write your name, register number and class in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

Answer all questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.

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 .

At the end of the paper, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question. The total number of marks for this paper is **80**.

Errors	Qn No.	Errors	Qn No.
Accuracy		Simplification	
Brackets		Units	
Geometry		Marks Awarded	
Presentation		Marks Penalised	



Parent's/Guardian's Signature:



2 hours

Compound Interest

Total amount =
$$P\left(1 + \frac{r}{100}\right)^n$$

Mensuration

Curved surface area of a cone =
$$\pi rl$$

Surface area of a sphere = $4\pi r^2$

Volume of a cone =
$$\frac{1}{3}\pi r^2 h$$

Volume of a sphere
$$=$$
 $\frac{4}{3}\pi r^3$

Area of triangle
$$ABC = \frac{1}{2}ab\sin C$$

Arc length = $r\theta$, where θ is in radians

Sector area =
$$\frac{1}{2}r^2\theta$$
, where θ is in radians

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$Mean = \frac{\sum fx}{\sum f}$$

Standard deviation =
$$\sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

3 Answer **all** the questions.

1 Evaluate
$$\sqrt[3]{\frac{2.3^2 - \pi}{4.5 \times 1.3}}$$
, giving your answer correct to 2 significant figures.

Answer[1]

2 Express 20m/s in km/h.

3 Sketch the graph of $y = 3^{x} + 1$ on the axes below. Indicate clearly the coordinates where the graph crosses the axes. y 0 x

[2]

Molly plans to sell her COACH wallet which she bought in her recent trip to Orlando.
 She will make a profit of 24% if she sells the wallet at \$527.
 Jolly asks Molly to sell at \$582 so that she can make a 40% profit.
 Is Jolly correct? By showing your working clearly, justify your answer.

Answer

[2]

5 Given that $-5 \le x < 2$ and $0 < y \le 8$, where x and y are integers, find the (a) greatest integer value of $x^2 + y$,

Answer[1]

Answer[1]

6 Simplify $\frac{3a^3b^2}{(a+3b)^2} \div \frac{9a^2}{4ab+12b^2}$.

(**b**) least integer value of
$$\frac{2x}{y}$$
.

7 Without solving the equations, explain why the pair of simultaneous equations below has no solution. Show your working clearly.

$$4x - 2y = 6$$
$$6x - 3y = 11$$

Answer

8 Cement, sand and soil were mixed in the ratio 2 : 3 : 4. After using two third of the mixture, 36 kg of the mixture is left. Find the initial mass of soil used in the mixture.

Answer mass of soilkg [2]

[2]

9 Expand and simplify $2(3x-5)^2 - (4x+7)(1-2x)$

Answer[2]

10 Given that $\frac{3x-5y}{2x-4y} = \frac{3}{7}$, find the value of $\frac{x}{y}$.

Answer[2]

11 The areas of the top, side and front of a cuboid are 120 cm², 80 cm² and 96 cm² respectively. Given that the length, breadth and height of the cuboid are all whole numbers, find the volume of the cuboid.



12 Solve
$$\frac{2x-1}{5} - \frac{4x+3}{3} = 2(x+7)$$
.

Answer x =[3]

13 In the diagram below, AD = DE and the line AC is perpendicular to CE. Angle $BAC = 40^\circ$, angle $ABC = 106^\circ$ and angle $AED = 17^\circ$.



Stating your reason(s) clearly,(a) calculate angle *ADE*,

Answer Angle ADE =^o[1]

[2]

(b) show that *DE* is parallel to *BC*. *Answer*

9

- **14** Factorise completely
 - (a) $8ax^3y 50axy^3$,

(b) 15ax - 30bx + 3ay - 6by.

Answer[2]

Answer[2]

15 (a) Solve the inequality $-7 + x < 2(x-5) + 1 \le 23$.

Answer[3]

[1]



The diagram shows a garden *OABC* in the shape of a sector centre *O*. *OC* = 20 m and angle $AOC = \frac{2\pi}{3}$ radians. The shaded area of the garden is to be covered with organic compost. It is known that 50 g of organic compost is required to cover 1 square metre of the area. Mandy bought 10 kg of organic compost and claims that it will be sufficient to cover the shaded area. Do you agree with her? Justify your answer with clear working.

Answer

[4]

17 In a survey of the number of passengers in a number of cars, the following data was collected.

Number of passengers	1	2	3	4
Number of cars	7	X	11	9

(a) If the mean number of passengers is $2\frac{2}{3}$, find the value of x.

Answer x =[2]

(b) If the modal number of passengers is 3, state the largest possible value of x.

Answer x =[1]

(c) If the median number of passengers is 3, find the largest possible value of x.

Answer x =[1]

18 The diagram below shows the three different sizes of Xinxin Mushroom soup and their prices at MinCares Supermarket.



(a) Sharon claims that the price of the mushroom soup is **not** proportional to the quantity of mushroom soup. Do you agree with her?

Answer	[2]
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(b) The cans used for the different sizes are all geometrically similar. The height of the 480 g can is 12 cm, calculate the height of the 260 g can.

19 Three points *W*, *X* and *Y* lie on level ground. The bearing of *W* from *Y* and the bearing of *X* from *Y* is 330° and 240° respectively. The bearing of *X* from *W* is 220° and WY = 6 m.



Find (a) the bearing of *Y* from *W*,

(**b**) angle *WXY*,

(c) the length of WX.

Answer angle *WXY* =º [2]

Answer WX =m [2]

- 20 The faces of a 4-sided die are numbered from 3 to 6. Two such dice are thrown and the product of the numbers shown on each die was calculated.
 - (a) Complete the possibility diagram below. \times 3 4 5 6

X	5	4	5	0
3		12		18
4	12	16		
5			25	30
6	18	24		

- (b) Using the possibility diagram above, find the probability that the product of the numbers is
 - (i) a prime number,

(ii) a perfect square, [1]

Answer[1]

(iii) an odd number between 20 and 30,

Answer[1]

(iv) a number that is a multiple of 5.

Answer[1]

[1]

21 *A* is the point (1, 2), $\overrightarrow{AB} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$, $\overrightarrow{AC} = \begin{pmatrix} -5 \\ -4 \end{pmatrix}$ and *M* is the mid-point of *BC*.

(a) Write down the position vector of point *A*.

(c) \overrightarrow{BC} ,

Find

(b)

 $\left|\overrightarrow{AC}\right|,$

Answer \overrightarrow{BC} =[1]

(d) \overrightarrow{AM} .

22 The diagram shows part of the graph of $y = ax^2 + bx + c$, where a, b and c are integers.



(a) Find the values of a, b and c.

Answer $a = \dots$	
<i>b</i> =	
<i>c</i> =	[3]

(b) State the equation of the line of symmetry of $y = ax^2 + bx + c$.

Answer[1]

(c) Joe claims that the line y = -26 does not intersect the graph of $y = ax^2 + bx + c$. Do you agree with him? Justify your answer. *Answer* [2]

- 23 (a) It is given that $\xi = \{x : x \text{ is an integer}, 0 < x \le 20\}$, $A = \{x : x \text{ is a factor of } 18\}$, $B = \{x : x \text{ is a perfect cube}\}$ and $C = \{x : x = 2^n, \text{ where } n \text{ is an integer}\}$.
 - (i) List all the elements of(a) C,

- (**b**) $A \cup B$.
- (ii) State the number of elements in $A \cap B$.

[1]

(b) On the Venn diagram below, shade the region representing $R' \cup (R \cap S')$. Answer ξ



(c) Use set notation to describe the shaded region in the Venn diagram below.



Answer[1]

(d) Given that $X = \{ \phi \}$, then X is an empty set. Do you agree with this statement? Justify your answer. *Answer*

17

[1]

- A quadrilateral *PQRS* is such that QR = 8 cm, PS = 7.5 cm, angle $QPS = 80^{\circ}$ and the 24 diagonal PR = 12 cm. The line PQ is drawn. **(a)**
 - In the space below, construct and label the
 - quadrilateral PQRS, (i)
 - angle bisector of angle *PSR*, **(ii)** [1]

[2]

perpendicular bisector of PQ. (iii) [1] Answer

(b) Write down the length of SR.

Р

Answer SR =cm [1]

X is a point, within *PQRS*, such that angle PSX > angle RSX and XQ > XP. (c) Shade the region which *X* can be found. [1]

. Q





4. Jolly is wrong.

Actual cost : \$425; with 40% profit, selling price should be \$595 Or, selling price of \$582 translate to a 36.9% profit not 40% profit.

5. (a) 33 (b) – 10

$$4ab^3$$

6. $\frac{4ab}{3(a+b)}$

7. Both lines have <u>same gradient but different y-intercept</u>, this means that they are <u>parallel</u> and <u>will not intersect each other</u>, so there is no solution to the pair of simultaneous equations.

16

BI

⇒z

8.
$$48 \text{ kg}$$

9. $26x^2 - 50x + 43$
10. $\frac{23}{15}$ or $1\frac{8}{15}$
11. Dimension of cuboid is $12 \times 8 \times 10$; vol = 960 cm³.
12. $x = -5\frac{2}{11}$ or -5.18 or $-\frac{57}{11}$
13. (a) 146°
14. (a) $2axy(2x-5y)(2x+5y)$ (b) $3(a-2b)(5x+y)$
15. (a) $2 < x \le 16$
(b)
Answer

I do not agree with Mandy as the shaded areas requires 12.3 kg (> 10kg) of compost to cover. OR
 I do not agree with Mandy as 10kg of compost can only cover 200 m² of land and the

I do not agree with Mandy as 10kg of compost can only cover 200 m² of land and the area of the shaded region is 245.67 m² > 200 m².

17. (a)
$$x = 6$$
 (b) $x = 10$ (c) $x = 12$

18. (a) Since the ratio of $\frac{\text{Price}}{\text{Quantity}}$ or $\frac{\text{Quantity}}{\text{Price}}$ is not a constant, the price of mushroon

soup is not proportional to the quantity of mushroom soup. I agree with Sharon.

19. (a)
$$150^{\circ}$$
 (b) 20° (c) 17.5 m

20.

(a) Complete the possibility diagram below.

21. (a)
$$\overrightarrow{OA} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$$
 (b) $\sqrt{41}$ or 6.40 (c) $\overrightarrow{AM} = \begin{pmatrix} -1 \\ -3 \end{pmatrix}$

- 22. (a) a = 1, b = -4, c = -21
 (b) The min value of y = ax² + bx + c is 25, so y = -26 will not intersect the graph. Joe is correct and I agree with him.
 23. (a) (i) (a)1,2,4,8,16 (b) 0, 1,2,3,6,9,18 (a)(ii) 1
- 23. (a) (i) (a)1,2,4,8,16 (b) 0, 1,2,3,6,9,18 (a)(ii) 1 (b)



(d) I do not agree as X contains the element ϕ , so it is not an empty set.