CHUNG CHENG HIGH SCHOOL (YISHUN)

NA

2023 Preliminary Examination
Secondary Four Normal Academic

CANDIDATE NAME | MARKING SCHEME

CLASS | INDEX NUMBER

MATHEMATICS 4045/01

Paper 1 27 July 2023

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use paper clips, glue or correction fluid.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an approved scientific calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.
Up to 2 marks may be deducted for improper presentation.

The number of marks is given in brackets [ ] at the end of each question or part question.

Question Number	Marks Possible	Marks Obtained	Question Number	Marks Possible	Marks Obtained
1	2		**11**	3	
2	3		**12**	3	
3	2		**13**	3	
4	5		**14**	3	
5	4		**15**	3	
6	3		**16**	1	
7	6		**17**	3	
8	5		**18**	4	
9	3		**19**	6	
10	4		**20**	4	
Presentation Deduction		**– 1 / – 2**			
TOTAL	**70**				

This document consists of **15** printed pages and **1** blank page.

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Mathematical Formulae

Compound Interest

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

Measurement

$$\text{Curved surface area of a cone} = \pi rl$$

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

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

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

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

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

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

Trigonometry

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

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

Statistics

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

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

Answer all the questions.

1 $\frac{7}{2}$ $\quad 330\%$ $\quad \frac{\pi}{2}$ $\quad 0.325$ $\quad \frac{12}{15}$

Write these numbers in descending order.

Answer: $\frac{7}{2}, 330\%, \frac{\pi}{2}, \frac{12}{15}, 0.325$ [2]

2 (i) Solve $-4x-6 \le -21$ and represent your answer on a number line.

Answer:

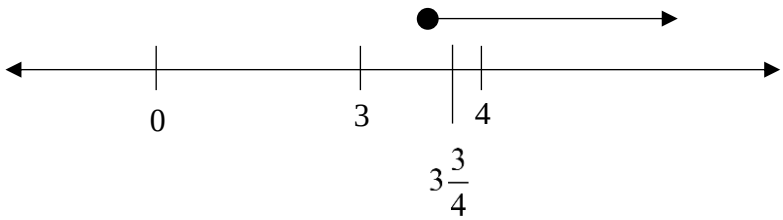
$-4x-6 \le -21$ [2]

$-4x \le -21+6$

$-4x \le -15$

$x \ge \frac{-15}{-4}$

$x \ge 3\frac{3}{4}$



(ii) Hence, find the smallest integer that satisfies $-4x-6 \le -21$.

Answer: ..... 4 ..... [1]

3 (a) Sarah mixes 0.4 kg of flour with 250 g of butter.

Write the ratio of butter : flour in its simplest form.

250 : 400

5 : 8

Answer: ..... 5 ..... **:** ..... 8 ..... [1]

(b) A bag contains only blue and pink bean bags.

$\frac{3}{11}$ of the bean bags are pink.

Write the ratio pink bean bags : blue bean bags in its simplest form.

Answer: 3 **:** 8 [1]

4 **(a)** Write 628 as a product of its prime factors.

$628 = 2^2 \times 157$

Answer: $628 = 2^2 \times 157$ [1]

(b) Find the largest perfect square that is a factor of 600.

$600 = 2^3 \times 3 \times 5^2$

Largest square = $2^2 \times 5^2$

$= 100$

Answer: 100 [2]

(c) $280 = 2^3 \times 5 \times 7$

Find the lowest common multiple (LCM) of 280 and 600. Give your answer as a product of its prime factors.

LCM of 280 and 600 = $2^3 \times 3 \times 5^2 \times 7$

Answer: $2^3 \times 3 \times 5^2 \times 7$ [1]

(d) Find the smallest positive integer of x such that $600x$ is a perfect cube.

$600 = 2^3 \times 3 \times 5^2$

$600x = 2^3 \times 3 \times 5^2 \times 3^2 \times 5$

$x = 45$

Answer: 45 [1]

5 **(a)** Given that $v = \frac{d^2}{2} - a$, find the value of v when $a = 5$ and $d = -8$.

$v = \frac{(-8)^2}{2} - (5)$

$v = 27$

Answer: 27 [2]

(b) Make d the subject of the formula $v = \frac{d^2}{2} - a$.

$\frac{d^2}{2} = v + a$

$d^2 = 2(v + a)$

$d = \pm\sqrt{2(v + a)}$

$d = \pm\sqrt{2(v + a)}$

Answer: [2]

6 Simplify $\frac{(5ad)^2}{x} \times \frac{a}{6} \div \frac{d^3}{2^0}$.

$= \frac{25a^2d^2}{x} \times \frac{a}{6} \times \frac{1}{d^3}$

$= \frac{25a^3}{6dx}$

Answer: $\frac{25a^3}{6dx}$ [3]

7 **(i)** Sheldon wanted to invest \$18 000 in a saving plans with a compound interest of 5% half yearly for 4 years in Bank A. Calculate the total interest that he received at the end of the 4 years.

$$A = \$18000\left(1+\frac{5/2}{100}\right)^{4\times 2}$$

$$A = \$21931.25216$$

$$I = \$21931.25216 - \$18000$$

$$I = \$3931.25216$$

$$I = \$3931.25 \text{ (2 dp)}$$

Answer: \$ 3931.25 ..... [3]

(ii) Sheldon is also thinking of investing in Bank B with the same amount of \$18 000 and the same duration of 4 years. However, Bank B charged simple interest with rate of 6% per annum. Which Bank should Sheldon invest in? Explain your answer with reasonings.

$$I = \$\frac{18000(6)(4)}{100}$$

$$I = \$4320$$

$$I_B > I_A$$

Answer: Bank B .....

This is because Bank B will allow Sheldon to earn more interest as compared to Bank A. .....

.....

..... [3]

8 Expand and simplify

(i) $2(c+p)-(-7p+4c)$,

$$2c+2p+7p-4c$$

$$= 9p-2c$$

Answer: $9p-2c$ ..... [2]

(i) $(5x-2)(2x+3)-2(5x-3)(x+1)$.

$=\left(10x^2+15x-4x-6\right)-\left(2\left(5x^2+5x-3x-3\right)\right)$

$=10x^2+11x-6-\left(2\left(5x^2+2x-3\right)\right)$

$=10x^2+11x-6-10x^2-4x+6$

$=7x$

Answer: $7x$ ..... [3]

9 **(i)** Expand $p^2-(p+a)(p-a)$.

$p^2-\left(p^2-a^2\right)$

$=p^2-p^2+a^2$

$=a^2$

Answer: a^2 ..... [2]

(ii) Hence, write down the value of $123456^2-(123459)(123453)$.

$123456^2-(123456+3)(123456-3)$

$=3^2$

$=9$

Answer: 9 ..... [1]

10 $x^2 - 16x + 8 = (x - a)^2 + b$

(a) Find the value of a and of b.

$(x-8)^2 - (8)^2 + 8$

$(x-8)^2 - 56$

Answer: a = 8 , b = -56 [2]

(b) Hence, solve $x^2 - 16x + 8 = 0$, giving your answers correct to 2 decimal places.

$(x-8)^2 - 56 = 0$

$(x-8)^2 = 56$

$(x-8) = \pm\sqrt{56}$

$x = \sqrt{56} + 8$ or $x = -\sqrt{56} + 8$

x = 15.48331 or x = 0.51669

Answer: x = 15.48 or x = 0.52 [2]

11 Janelle travels from Singapore to Thailand. She exchanged $400 into Thai Baht when the exchange rate was 1 Thai Baht = $0.03875. While in Thailand, she spent 6500 Baht. On her return, she exchanged the remaining Baht into dollars when the exchange rate was 1 Thai Baht = $0.03765. How much Singapore dollars did she receive?

$\$1 = \frac{1}{0.03875}$ Thai Baht

$\$400 = \frac{1}{0.03875} \times 400$ Thai Baht

= 10322.58065 Thai Baht

Remaining amount of Thai Baht

= 10322.58065 – 6500

= 3822.58065

1 Thai Baht = $0.03765

3822.58065 Thai Baht = $0.03765 × 3822.58065

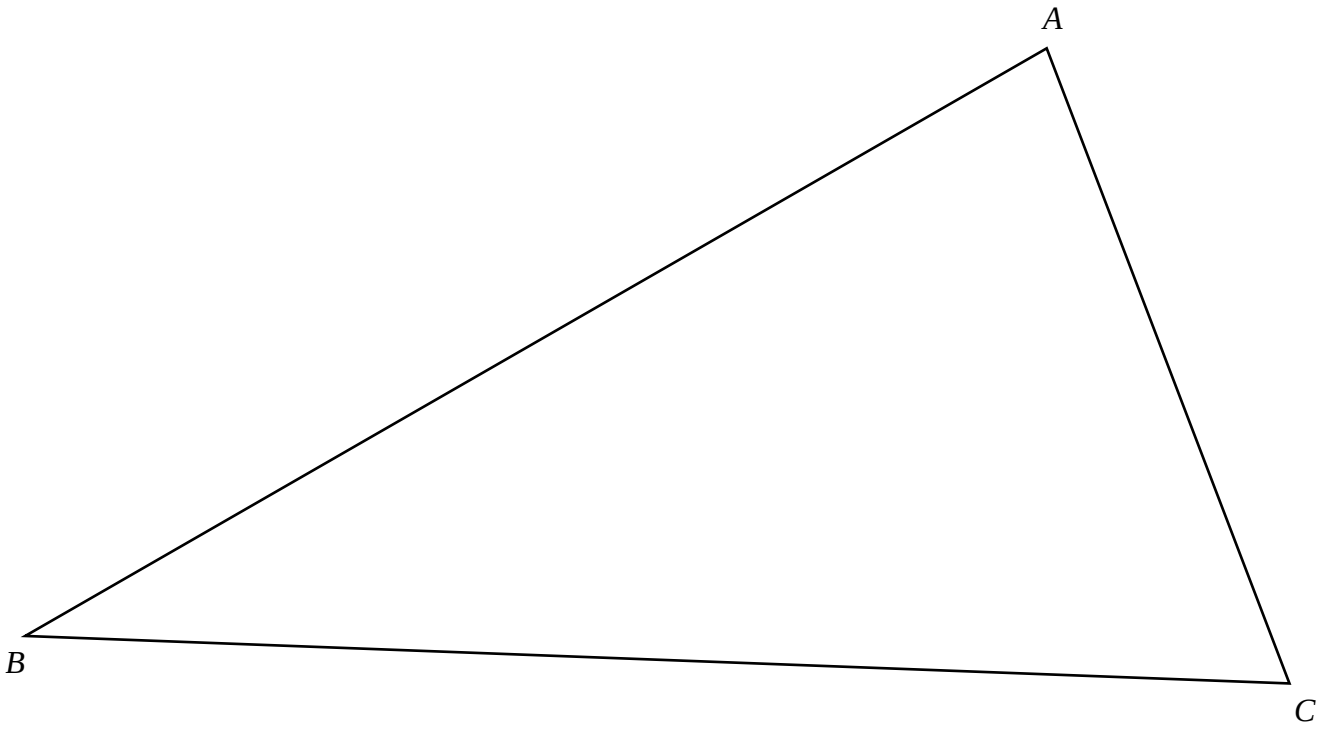
= $143.92016

Answer: $143.92 [3]

12 Point *E* is on the intersection point of the bisector of angle *ACB* and perpendicular bisector of *BC*.

(a) Use only ruler and compass to locate and label *E* in the answer space below. [2]

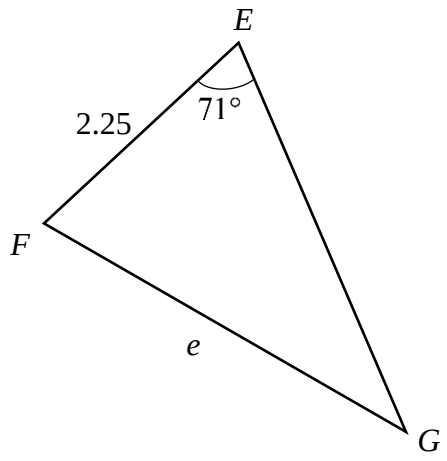
Answer:

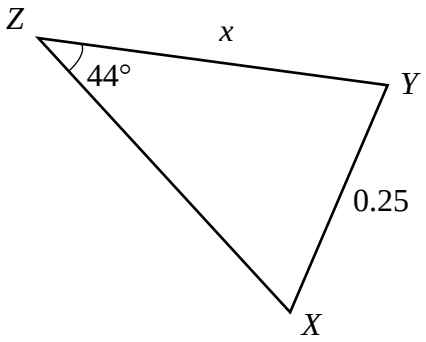


(b) Measure *BE*.

Answer: ……10.1…… cm [1]

13 *EFG* and *XYZ* are similar triangles with all the length given in cm.





(a) Find $\angle EFG$.

$\angle G = 44°$ (corresponding $\angle$ in a triangle)

$\angle EFG = 180° - 44° - 71°$ ($\angle$ sum of a triangle)

$= 65°$

Answer: 75° ° [1]

(b) Triangle *EFG* is an enlargement of triangle *XYZ*. Find the scale factor.

Scale factor $= \frac{2.25}{0.25}$

$= 9$

Answer: 9 [1]

(c) Hence, find x in terms of e.

$\frac{e}{x} = 9$

$x = \frac{e}{9}$

Answer: $x = \frac{e}{9}$ [1]

14 The *y*-intercept of the line $ky-5x+14=0$ is –2. Find

(a) the value of *k*.

$ky=5x-14$

$y=\frac{5}{k}x-\frac{14}{k}$

$-\frac{14}{k}=-2$

$k=7$

Answer: k = 7 [2]

(b) the gradient of the line.

Gradient = $\frac{5}{7}$

Answer: $\frac{5}{7}$ [1]

15 There are three points *X* (1, 8), *Y* (3, *m*) and *Z* (–1, 13). If *XY* = *XZ*, find the value of *m* where $m>5$.

$\sqrt{(1-3)^2+(8-m)^2}=\sqrt{(1-(-1))^2+(8-13)^2}$

$(1-3)^2+(8-m)^2=(2)^2+(-5)^2$

$(8-m)^2=4+25-4$

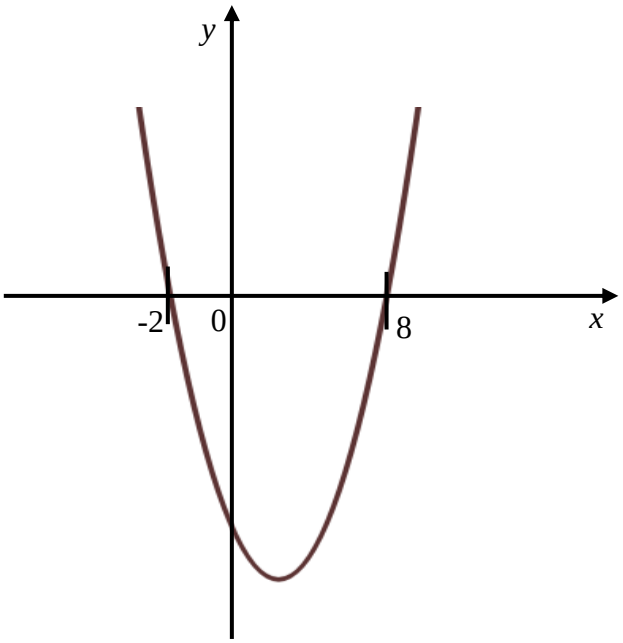
$8-m=\pm\sqrt{25}$

$m=8+5$ or $m=8-5$

m =13 or m = 3 (rej as $m>5$)

Answer: m = 13 [3]

16 State the equation of the line of symmetry of the following quadratic curve.



$x = \frac{8+(-2)}{2}$

Answer: $x =$ 3 ..... [1]

17 A group of elderly were asked for their favourite hobby. The results are summarised on the accurate pie chart below. The number of elderly who like reading is 50 more than the number of elderly who like cycling. Find the total number of elderly in the group.

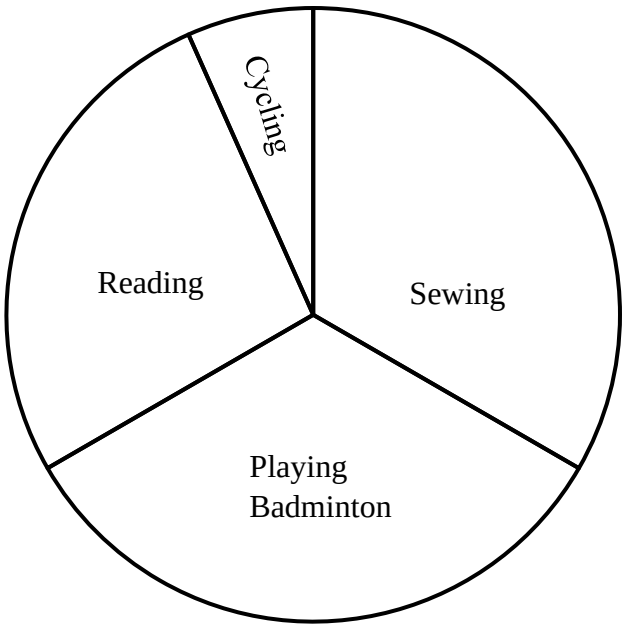
$96° - 24° = 72°$

$72° - 50$ elderly

$1° - \frac{50}{72}$ elderly

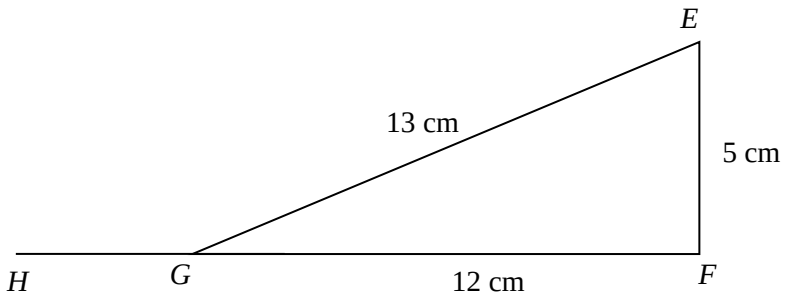
$360° - \frac{50}{72} \times 360$ elderly

$= 250$



Answer: 250 ..... [3]

18 In the figure, EF and FG are straight lines. It is also given that EF = 5 cm and EG = 13 cm.



(a) Showing clearly your working steps, determine whether triangle EFG is a right-angled triangle.

Answer: $EG^2 = 13^2$ $EF^2 + GF^2$

$EG^2 = 169$ $5^2 + 12^2 = 169$

$EG^2 = EF^2 + GF^2$

By converse of Pythagoras Theorem, ΔEFG is a right-angle Δ

[2]

(b) Expressing your answer as a fraction, write down

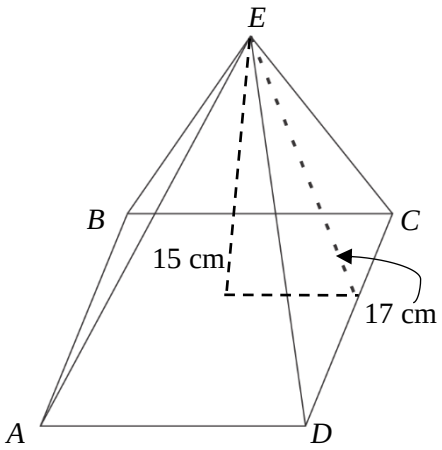
(i) $\sin \angle FEG$,

Answer: $\sin \angle FEG = \frac{12}{13}$ [1]

(ii) $\cos \angle EGH$.

Answer: $\cos \angle EGH = -\frac{12}{13}$ [1]

19 The diagram shows a candle in the shape of a pyramid *ABCDE*. The slant height of the surface is 17 cm and the vertical height is 15 cm.



(a) Explain why the base length of the pyramid is 16 cm.

Answer: [2]

Let MX be the distance from the of the base to the end of the base

$17^2 = 15^2 + MX^2$

$MX^2 = 17^2 - 15^2$

$MX = 8$

Therefor base length = 8×2 = 16 cm

(b) Calculate the volume of the pyramid.

$$\text{Volume} = \frac{1}{3} \times (16 \times 16) \times 15$$

$$= 1280 \text{ cm}^3$$

Answer: 1280 cm^3 [2]

(c) The candle is melted and reshaped into a sphere with diameter 4 cm. Find the maximum number of spheres that can be formed.

$$\text{Volume of sphere} = \frac{4}{3} \times \pi \times (2)^3$$

$$= \frac{32\pi}{3}$$

$$\text{No of sphere} = 1280 \div \frac{32\pi}{3}$$

$$= 38.19719$$

Answer: 38 cm [2]

20 The stem-and-leaf diagram below represents the mass of 30 boys and girls in class 2 Respect.

Leaf for boys	Stem	Leaf for girls
8	3	5 6
7 2	4	4 8 9
8 5 6 2	5	0 0 1 2 5 7 9
4 7 5 2 2 0	6	2 5
5 1	7	3

Key (Girls): 5|0 represents 50 kg	Key (Boys): 2|5 represents 52 kg

(a) Find the modal mass for the girls.

Answer: 50 ……kg [1]

(b) Find the median mass of the boys.

Answer: 60 ……kg [1]

(c) A girl who was previously absent has her mass measured as 55 kg. Explain with calculations whether this new data will have any effect on the median mass for the girls.

Old median = 51 kg

New median = $\frac{51+52}{2} = 51.5$ kg

Answer: ……

There is a change of 0.5kg from the old median to the new one.

……

……

…… [2]