



GCSE Preliminary Examination Mock Paper 2022
SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC

CANDIDATE
NAME

CENTRE

ELEMENTARY MATHEMATICS

4048/01

Mock Paper 1

August 2022

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name and centre in the spaces at the top of this page.

Write in dark blue or black pen.

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

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

Answer **all** the questions.

Give non-exact numerical answers correct to 3 significant figures, or 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.

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**.

Grade Tables: For Examiner's Use

Total Score	Deductions			Grade
	Rounding	Units	Presentation	

Setter: **Kaiwen** :)

This question paper consists of 23 printed pages including the cover page

Grade Tables: For Examiner's Use

Question	Points	Score	Question	Points	Score
1	2		13	8	
2	2		14	5	
3	2		15	3	
4	2		16	2	
5	2		17	3	
6	5		18	3	
7	3		19	3	
8	2		20	5	
9	3		21	2	
10	6		22	4	
11	5		23	5	
12	3		Total:	80	

Examiner's Comments

List of Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

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

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

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 questions: 80 marks

1. Calculate the following

$$\frac{23 - \left(-4\frac{3}{5}\right)^3}{\sqrt[3]{(7.2)^2 + \sqrt{6.81}}}$$

(a) Write down the first five digits on your calculator display

Answer _____ [1]

(b) Write down your answer to **part (a)** correct to 1 significant figure

Answer _____ [1]

2. Determine which of the following is greater. Justify your answer with clear calculations

$$3^{400} \qquad 8^{200}$$

Answer _____ [2]

3. Show that, for all p , where p is a positive integer, the following is divisible by 15

$$(7p - 3)^2 - 4p(p - 3) + 6$$

Answer

[2]

4. It is given that

$$\mathcal{E} = \{x : x \text{ is an integer, } 0 \leq x < 14\}$$

$$A = \{\text{factors of 24}\}$$

$$B = \{\text{even numbers}\}$$

List the elements in

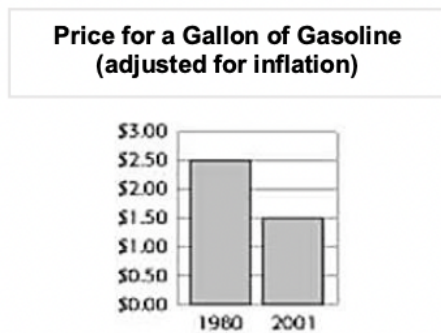
(a) A'

Answer _____ [1]

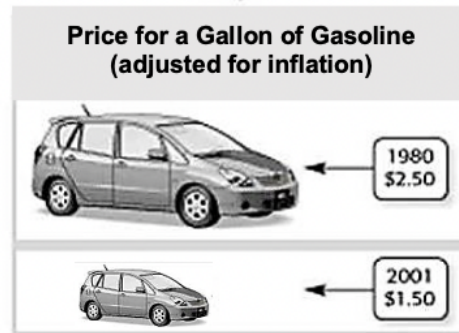
(b) $A' \cap B'$

Answer _____ [1]

5. The two graphs below show the prices of a gallon of gasoline in the United States in 1980 and 2001



Graph A

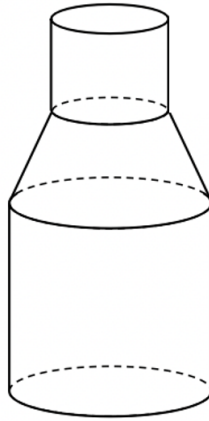


Graph B

Which graph could be used to give the impression of a greater decrease in the price of gasoline from 1980 to 2001? Justify your answer with appropriate calculations

Answer _____ [2]

6. In a particular milk factory, a machine takes 17 seconds to fill a bottle of milk.

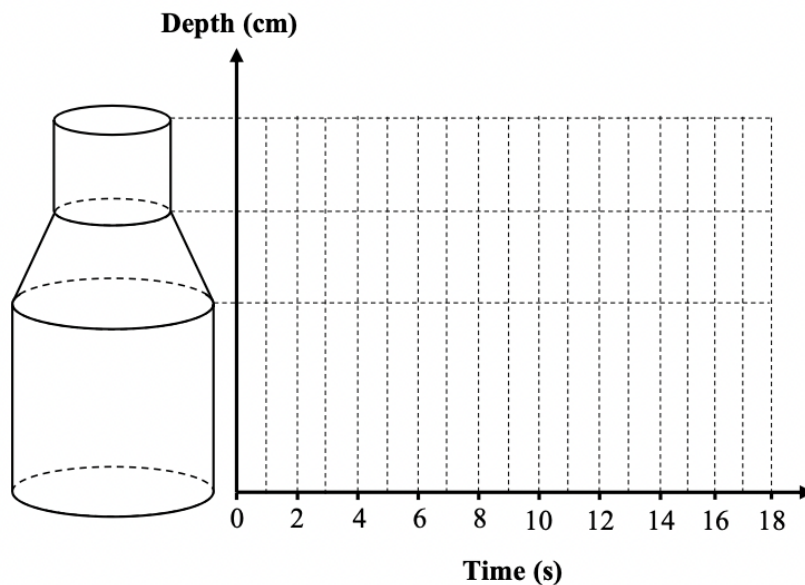


The bottle is made of 2 similar cylinders and a frustum. The radius of the big cylinder is twice that of the small cylinder. Given that it takes 12 seconds to fill the big cylinder,

(a) Find the time needed to fill the **frustum**

Answer _____ [2]

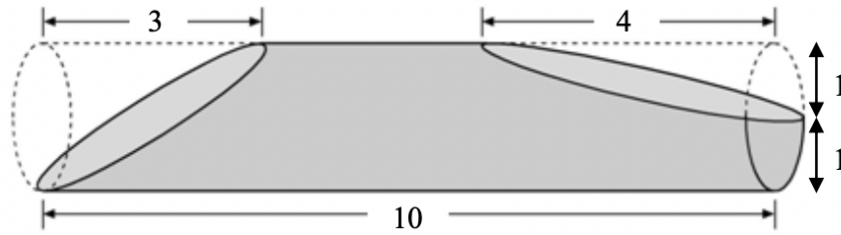
(b) Sketch the depth-time graph, showing how the depth of milk varies over the 17 seconds



NOTE: You **DO NOT** need to calculate the relevant heights

[3]

7. A cylindrical sausage has a length of 10 cm and a diameter of 2 cm. Two straight cuts are made to the sausage as shown below



One cut is made 3 cm from the top left end to the bottom left end. The other cut is made 4 cm from the top right end to the diameter of the right end at the centre. Find the volume of the sausage that remains. Give your answer in terms of π

Answer _____ [3]

8. Tom and Jerry have the same total number of coins. Tom has a number of 50-cent coins and 64 twenty-cent coins. The total mass of his coins is 1.134 kg. Jerry has a number of 50-cent coins and 104 twenty-cent coins
- (a) Who has more money in coins and how much more?

Answer _____ [1]

- (b) Each 50-cent coin is 2.7 grams heavier than each 20-cent coin.
What is the total mass of Jerry's coins in kg?

Answer _____ [1]

9. Joshua was solving a quadratic equation using the 'completing the square' method but he could not get the desired solution.

$$2x^2 + 4x - 16 = 0$$

His first four steps of working are shown below

$$2x^2 + 4x - 16 = 0$$

$$2x^2 + 4x = 16$$

$$(2x + 2)^2 - 4 = 16$$

$$(2x + 2)^2 = 16 + 4$$

...

Assuming that the starting equation and desired solution is correct,

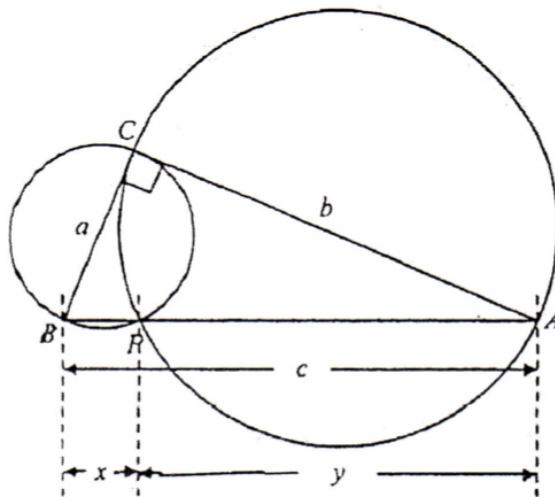
- (a) **Circle** the line with the error from his workings above

[1]

- (b) Continue solving the question for Joshua

Answer _____ [2]

10. The diagram shows 2 circles with diameters AC and BC



$\angle ACB$ is a right-angle. The two circles intersect at C and P

(a) By considering the angle properties of circles, show that BPA forms a straight line

Answer

[2]

(b) State 2 triangles similar to $\triangle ABC$

Answer _____ [1]

(c) Using your answer in **part (b)**, show that

(i)

$$a^2 = xc$$

Answer

[1]

(ii)

$$b^2 = yc$$

Answer

[1]

(d) **Hence**, using all the results from **part (b) & (c)**, show that

$$a^2 + b^2 = c^2$$

Answer

[1]

11. (a) Simplify the following expression

$$\frac{x+1}{x^2-9} - \frac{2}{3-x}$$

Answer _____ [2]

(b) Simplify the following expression, leaving your answer in positive indices

$$\frac{(abc^{-2})^3}{(a^{-4}b^{-1})^{-1}} \times \frac{a^{-6}b^{-7}}{(bc^2)^{-4}}$$

Answer _____ [3]

12. The first 5 powers for 4, 5, and 7 are shown below

n value	4^n	5^n	7^n
1	$4^1 = 4$	$5^1 = 5$	$7^1 = 7$
2	$4^2 = 16$	$5^2 = 25$	$7^2 = 49$
3	$4^3 = 64$	$5^3 = 125$	$7^3 = 343$
4	$4^4 = 256$	$5^4 = 625$	$7^4 = 2401$
5	$4^5 = 1024$	$5^5 = 3125$	$7^5 = 16807$

Using the above information only, **without the use of a calculator**, find the last digit of the following sum. Show all your working clearly

$$4^{30} + 7^{84} - 5^{55}$$

Answer _____ [3]

13. A regular pentagon $ABCDE$ and a regular hexagon $AEFGHI$ are joined along AE , the common side, to form the Figure 1

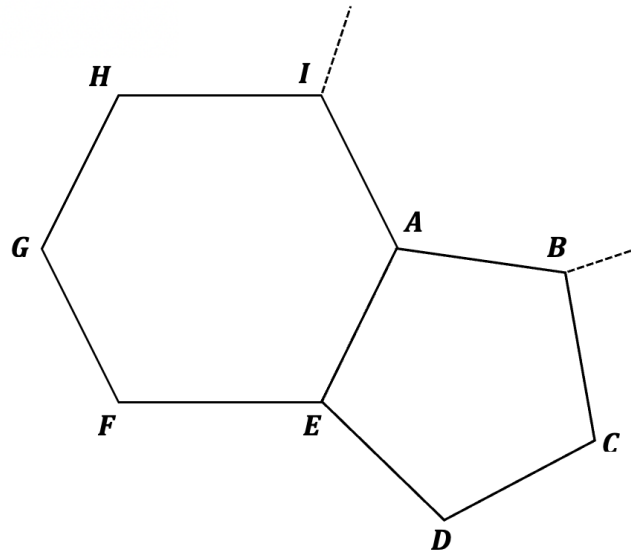


Figure 1

- (a) State the **FULL DEFINITION** of the word regular (in the context of polygons)

Answer

[1]

- (b) Explain, with mathematical calculations, why the line segment AB and AI cannot be part of a bigger regular polygon

Answer

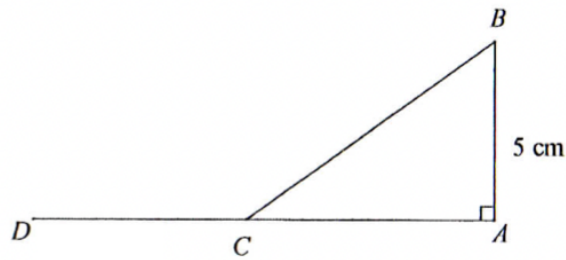
[3]

(c) Given that $AE = 8$ cm, calculate the area of Figure 1 (pentagon + hexagon **ONLY**)

Answer _____ [4]

14. In triangle ABC , $AB = 5$ cm, $\angle CAB = 90^\circ$. AC is produced to D . It is also given that

$$\sin \angle BCD = \frac{3}{5}$$



(a) Show that

$$BC = 8\frac{1}{3} \text{ cm}$$

Answer

[1]

(b) Calculate the length of AC

Answer _____ [2]

(c) Find the value of the following, giving your answer as a fraction

(i) $\sin(90^\circ - \angle BCA)$

Answer _____ [1]

(ii) $\cos \angle BCD$

Answer _____ [1]

15. The equation of a curve is given as such, where b and c are constants

$$y = x^2 + bx + c$$

(a) Given that $(2, 0)$ is a point on the curve, show that

$$b = -\frac{4 + c}{2}$$

Answer

[1]

(b) If the y -intercept of the curve is 14, find the values of b and c

Answer _____ [2]

16. V is inversely proportional to the cube of T . Calculate the percentage change in V , given that T is increased by 300%

Answer _____ [2]

17. Factorise the following completely

(a) $(d + e)^2 - 2(d + e) - 8$

Answer _____ [1]

(b) $1 + x - 2a - 2ax$

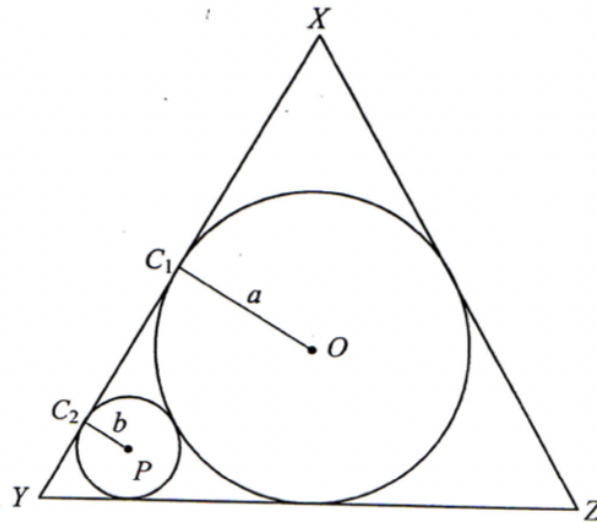
Answer _____ [2]

18. Given that $1 < y < 2$, arrange the following expressions in **ascending** order of magnitude

$$\frac{1}{y^{-2}} \div \frac{1}{y^3} \quad \frac{1}{(y-3)^3} \times \frac{(y-3)^2}{1} \quad \frac{y^{-2}}{4y^{-3}}$$

Answer _____ [3]

19. A circle, C_1 , with centre O , is inscribed in an equilateral triangle XYZ . A second circle C_2 , with centre P , is tangent to the circle C_1 , XY and YZ



Find the ratio of the radii of the two circles $a : b$

Answer _____ [3]

20. (a) A 2×2 identity matrix \mathbf{I} is where it is a 2×2 square matrix having 1s on the main diagonal (from top left to bottom right) only, and 0s everywhere else. **Circle** which of the following fits the description of matrix \mathbf{I}

$$\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix} \quad \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad \begin{pmatrix} 0 & 1 \\ 0 & 1 \end{pmatrix} \quad \begin{pmatrix} 1 & 0 \\ 1 & 0 \end{pmatrix} \quad \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \quad \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$$

[1]

- (b) Using your answer in **part (a)(i)**, and given that

$$\mathbf{N} = \begin{pmatrix} 1 & -2 \\ -3 & 4 \end{pmatrix} \quad \mathbf{O} = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$$

find the values of a and b such that

$$\mathbf{N}^2 + a\mathbf{N} - b\mathbf{I} = \mathbf{O}$$

Answer _____ [4]

21. In the following equation, where k is a constant, the solution is twice the value of k

$$\frac{3x}{4} + \frac{6x-5}{5} = k$$

Find the value of k

Answer _____ [2]

22. (a) Given that

$$8^a = 3 \times 10^{-3}$$

$$16^b = 10^2$$

$$4^c = 50$$

leaving your answer in standard form, find the value of

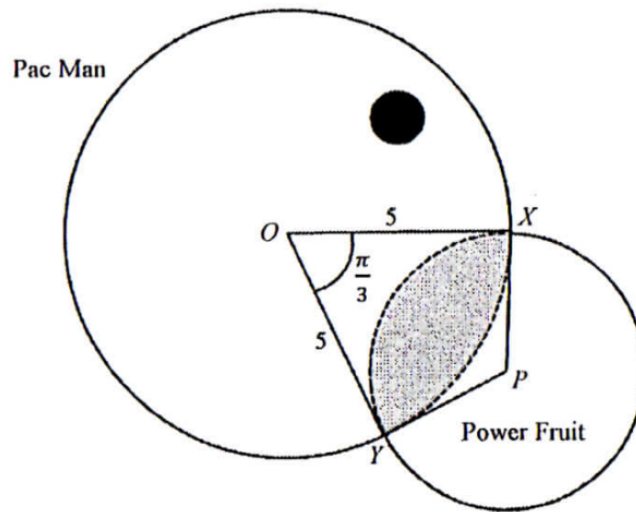
$$2^{3a+4b-2c}$$

Answer _____ [2]

(b) A factory produces 5.3 giga forks per year. Each fork has a mass of 3×10^{-2} kg and it was found that 0.08% of the fork produced has a defect. Calculate the total mass of defective forks produced in a year, leaving your answer in standard form

Answer _____ [2]

23. The diagram shows two circles, Pac Man, with centre O , and a Power fruit with centre P



They intersect each other at X and Y , such that OX is perpendicular to XP and OY is perpendicular to YP . The Pac Man bit off a portion of the Power fruit which is indicated by the shaded region. The length of the upper and lower jaws are 5 cm each, and is opened at $\frac{\pi}{3}$ radians while taking the bite. Find the area of the Power fruit that had been bitten off

Answer _____ [5]

END OF PAPER

Question Source

Question	Credit	Remarks
1	S4 P1/MGS 2017 MYE Qn 1	-
2	S4 P1/DSS 2017 MYE Qn 3	-
3	S4 P1/PHSS 2017 MYE Qn 5	-
4	S4 P1/BSS 2017 PRELIM Qn 2	-
5	S4 P1/MSS 2017 MYE Qn 11	-
6	S4 P1/AHS 2017 MYE Qn 12	-
7	S4 P1/PHS 2016 PRELIM Qn 23	-
8	P6 P2/PSLE 2021 Qn 15	Modified
9	S4 P2/BGSS 2017 PRELIM Qn 1(c)	Modified
10	S4 P1/DSS 2016 PRELIM Qn 22	Modified
11	S4 P1/CHIJ KC 2017 PRELIM Qn 1	-
12	S4 P1/PRSS 2017 PRELIM Qn 23	-
13	S4 P1/SST 2016 PRELIM Qn 18	Modified
14	S4 P1/EVSS 2017 PRELIM Qn 9	Modified
15	S4 P1/GMS(S) 2017 PRELIM Qn 4	-
16	S4 P1/HIHS 2017 PRELIM Qn 8	-
17	S4 P1/JYSS 2017 PRELIM Qn 8	-
18	S4 P1/DSS 2017 PRELIM Qn 11	-
19	S4 P1/PRSS 2017 PRELIM Qn 24	-
20	S4 P1/HIHS 2016 PRELIM Qn 19(a)	Modified
21	S4 P1/MFSS 2016 PRELIM Qn 17	-
22	S4 P1/NCHS 2016 PRELIM Qn 4	-
23	S4 P1/BMSS 2017 PRELIM Qn 24	-