



**JOE GQABI DISTRICT**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 11**

**OCTOBER 2023**

**MATHEMATICS**

**MARKS: 50**

**TIME: 1 HOUR**

*Stanmorephysics*

**This question paper consist of 5 pages including the cover page.**

## INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 6 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera which you have used in determining the answers.
4. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
5. If necessary, round off answers to TWO decimal places, unless stated otherwise.
6. Number the answers correctly according to the numbering system used in this question paper.
7. Write neatly and legibly.



**QUESTION 1**

1.1 Given the sequence:  $10 ; 7 ; 4 ; 1 ; \dots$

1.1.1 Write down the next two terms of the sequence. (2)

1.1.2 Determine the formula for the  $n^{\text{th}}$  term of the sequence. (2)

1.1.3 Which term of the sequence is equal to  $-179$  ? (3)

1.2 Given the first three terms of a linear sequence:  $3x - 2 ; x + 9 ; 2x + 5 ;$  Determine the value of  $x$ . (3)

[10]

**QUESTION 2**

Given the quadratic pattern:  $-128 ; -84 ; -48 ; -20 ; \dots$

2.1 Determine the next two terms of the pattern. (2)

2.2 Determine  $T_n$ , the general term of the pattern, in the form  $T_n = an^2 + bn + c$  (4)

2.3 Given that  $T_n = -4n^2 + 56n - 180$ , determine the biggest numerical value for  $T_n$ . (5)

2.4 Given that  $h(n) = T_n + k$ . For which values of  $k$  will  $T_n$  not have any positive values? (2)

[13]

**QUESTION 3**

Two number patterns, the one consisting of uneven numbers and the other consisting of even numbers, are combined to form a new number pattern as shown below.

$1 ; 2 ; 5 ; 6 ; 9 ; 18 ; 13 ; 54 ; \dots$

3.1 Write down the next TWO terms of the pattern. (2)

3.2 Calculate the  $31^{\text{th}}$  term of the pattern. (3)

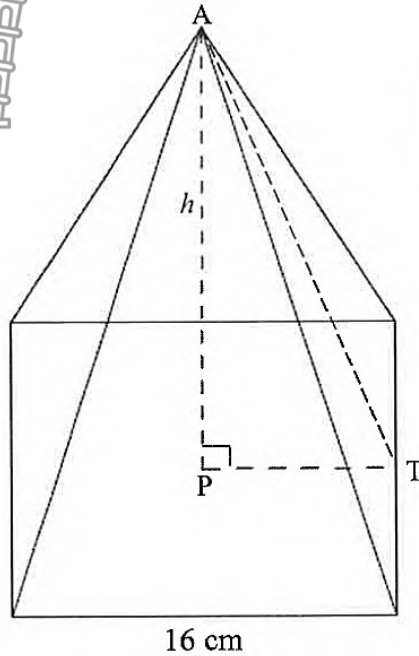
[5]



**QUESTION 4**

A pyramid with a square base with a side length of 16 cm is sketched below, P lies on the square base directly below A.

The volume of the pyramid is  $640\text{cm}^3$ .



Volume of pyramid =  $\frac{1}{3}Ah$

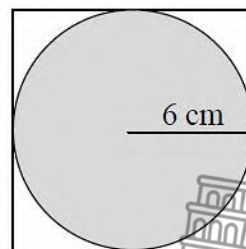
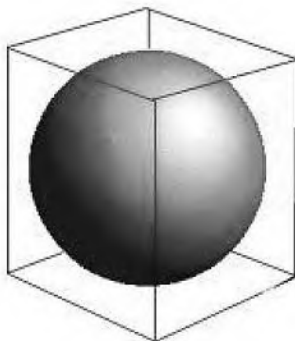
4.1 Show that the perpendicular height of the pyramid, AP, is 7,5 cm. (2)

4.2 Hence, determine the total surface area of the pyramid. (4)

**[6]**

**QUESTION 5**

A spherical glass ball is tightly packed in a box. The box is in the shape of a cube, as shown in the picture on the LEFT. The radius of the ball is 6 cm. The diagram on the RIGHT shows the cross-section of the glass ball placed in the box.

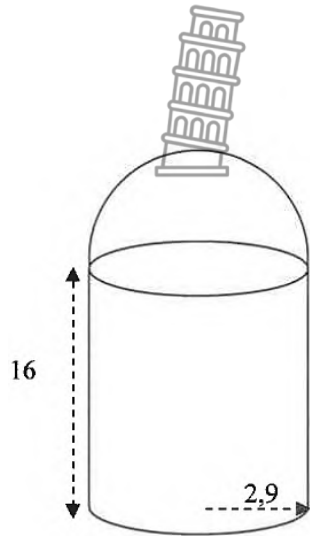


What volume of the box remains after the glass ball is placed in it?

**[6]**

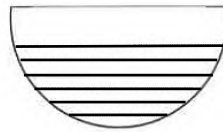
**QUESTION 6**

A cylindrical aerosol can has a lid in the shape of a hemisphere that fits exactly on the top of the can. The height of the can is 16 cm and the base of the can is 2,9 cm.



**FIGURE 1**

<p>Volume of sphere = <math>\frac{4}{3} \pi r^3</math></p> <p>Surface area of sphere = <math>4\pi r^2</math></p>
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**FIGURE 2**

- 6.1 Calculate the surface area of the can with the lid in place, as shown in FIGURE 1. (5)
- 6,2 If the lid is 80% filled with a liquid, as shown in FIGURE 2, calculate the volume of the liquid in the lid. (5)

**[10]**

**TOTAL: 50**





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**GRADE 11**

**MATHEMATICS TEST**

**OCTOBER 2023**

**MEMORANDUM**

**MARKS: 50**

**This memorandum consists of 6 pages including the cover page.**



**NOTE:**

- If a candidate answered a question TWICE, mark only the FIRST attempt.
- If a candidate crossed out an answer and did not redo it, mark the crossed-out answer.
- Consistent accuracy applies to ALL aspects of the marking memorandum.
- Assuming values/answers in order to solve a problem is unacceptable.




**QUESTION 1**

1.1.1	10; 7; 4; 1; <b>-2; -5</b>	✓ -2    ✓ -5	(2)
1.1.2	$T_n = 13 - 3n$	✓ 13    ✓ $-3n$	(2)
1.1.3	<del><math>-179 = 13 - 3n</math></del> $3n = 192$ $\therefore n = 64$	✓ equating $-179$ to $13 - 3n$ ✓ simplifying ✓ answer	(3)
1.2	$T_2 - T_1 = T_3 - T_2$ $x + 9 - (3x - 2) = 2x + 5 - (x + 9)$ $x + 9 - 3x + 2 = 2x + 5 - x - 9$ $-2x + 11 = x - 4$ $-3x = -15$ $\therefore x = 5$	✓ substitution ✓ simplification  ✓ answer	(3)
			<b>[10]</b>

**QUESTION 2**

2.1	<p style="text-align: center;"> <math>-128</math>    ;    <math>-84</math>    ;    <math>-48</math>    ;    <math>-20</math>    <math>T_5 = 0</math> and <math>T_6 = 12</math> </p>	✓ 0    ✓ 12	(2)
2.2	$2a = -8$ $3a + b = 44$ $a + b + c = -128$ $\therefore a = -4$ $3(-4) + b = 44$ $-4 + 56 + c = -128$ $b = 56$ $c = -180$  $\therefore T_n = -4n^2 + 56n - 180$	✓ $a = -4$ ✓ $b = 56$ ✓ $c = -180$ ✓ $\therefore T_n = -4n^2 + 56n - 180$	(4)
2.3	$T_n = -4n^2 + 56n - 180$ $= -4(n^2 - 14n + 45)$ $= -4(n^2 - 14n + 49 + 45 - 49)$ $= -4[(n - 7)^2 - 4]$ $= -4(n - 7)^2 + 16$ $\therefore$ biggest value for $T_n$ is 16  <p style="text-align: center;"><b>OR</b></p>	✓ common factor ✓ completing the square  ✓ $(n - 7)^2 - 4$ ✓ +16 ✓ identifying the biggest $T_n$ values	(5)



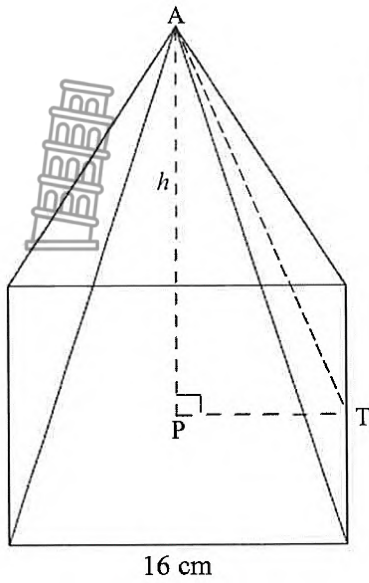
	$T_n = -4n^2 + 56n - 180$ $\text{max at: } n = -\frac{b}{2a}$  $= -\frac{(56)}{2(-4)}$ $= 7$ $\therefore T_7 = -4(7)^2 + 56(7) - 180$ $= 16$	✓ $-\frac{b}{2a}$ ✓ substitution ✓ $n = 7$ ✓ substituting $n = 7$ into $T_n$ ✓ answer (5)
2.4	$k \leq -16$	✓✓ answer (1 mark if $k < -16$ ) (5)
		<b>[13]</b>

**QUESTION 3**

Given: 1 ; 2 ; 5 ; 6 ; 9 ; 18 ; 13 ; 54 ; ...		
3.1	17 ; 162	✓ 17 ✓ 162 (2)
3.2	31 <sup>st</sup> term of the sequence is LINEAR. If the first term falls under odd numbers then the 31 <sup>st</sup> term will be odd as well, $\frac{31}{2} = 15,5 = 16 = n$ $T_n = 4n - 3$ $T_{31} = 4(16) - 3$ $= 16$ <b>OR</b> 1 ; 2 ; 5 ; 6 ; 9 ; 18 ; 13 ; 54 ; 17 ; 162 ; 21 ; 486 ; 25 ; 1 458 ; 29 ; 4 374 ; 33 ; 13 122 ; 37 ; 39 366 ; 41 ; 118 098 ; 45 ; 354 294 ; 49 ; 1 062 882 ; 53 ; 3 188 646 ; 57 ; 9 565 938 ; 61 The 31 <sup>st</sup> term of the sequence is 61.	✓ $n = 16$ ✓ $4n - 3$ ✓ answer (3) ✓✓ correct expansion ✓ answer (3)
		<b>[5]</b>



**QUESTION 4**

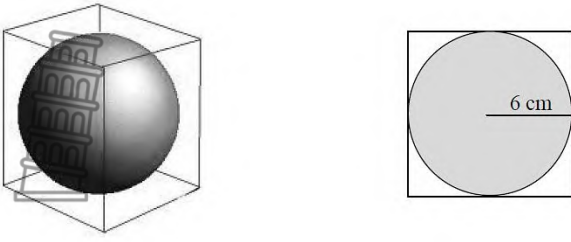


Volume of pyramid =  $\frac{1}{3}Ah$

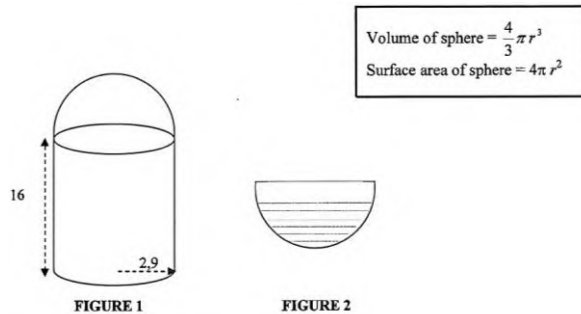
4.1	$V = \frac{1}{3}Ah$ $640 = \frac{1}{3} \times (16 \times 16) \times h$ $h = 7,5cm$	<ul style="list-style-type: none"> <li>✓ Area of square = <math>(16 \times 16)</math></li> <li>✓ Subst in volume form</li> </ul> <p style="text-align: right;">(2)</p>
4.2	<p>slant height = <math>\sqrt{7,5^2 + 8^2} = 10,9658\dots</math></p> <p>Total surface = <math>(side \times side) + 4 \left( \frac{1}{2}b \times \perp h \right)</math></p> $= (16 \times 16) + 4 \left( \frac{1}{2}16 \times 10,9658\dots \right)$ $= 606,91cm^2$	<ul style="list-style-type: none"> <li>✓ Subst in pyth</li> <li>✓ answer</li> <li>✓ Subst in SA</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(4)</p>
		<b>[6]</b>



**QUESTION 5**

		
	$\text{Volume of ball} = \frac{4}{3}\pi r^3$ $= \frac{4}{3}\pi(6)^3$ $= 288\pi \text{ cm}^3$ $\text{Volume of box} = (12)^3$ $= 1728\text{cm}^3$ $\therefore \text{Volume of box remaining} = 1728 - 288\pi$ $= 823,22 \text{ cm}^3$	<ul style="list-style-type: none"> <li>✓ subst into correct formula</li> <li>✓ <math>288\pi \text{ cm}^3 / 904.77\dots</math></li> <li>✓ <math>12^3</math></li> <li>✓ 1728</li> <li>✓ subtraction</li> <li>✓ 823,22</li> </ul>
		<b>[6]</b>

**QUESTION 6**



6.1	$\text{Surface are} = 2\pi r h + \pi r^2 + 2\pi r^2$ $= 2\pi r h + 3\pi r^2$ $= 2\pi(2,9)(16) + 3\pi(2,9)^2$ $= 370,80 \text{ cm}^2$	<ul style="list-style-type: none"> <li>✓ SA of tin</li> <li>✓ SA of Hemisphere</li> <li>✓ SA of base</li> <li>✓ subst</li> <li>✓ answer</li> </ul>
		(5)
6.2	$\text{Volume of hemisphere} = \frac{1}{2} \times \frac{4}{3}\pi r^3$ $= \frac{1}{2} \times \frac{4}{3}\pi(2,9)^3$ $= 16,26\pi \text{ or } 51,0822\dots$ $80\% \text{ of } = 0,8 \times 16,26\pi$ $= 40,86 \text{ cm}^3$	<ul style="list-style-type: none"> <li>✓ V of hemisphere</li> <li>✓ subst</li> <li>✓ 51,0822...</li> <li>✓ <math>0,8 \times 16,26\pi</math> or 51,.</li> <li>✓ answer</li> </ul>
		(5)

**[10]**

**TOTAL: 50**

