SMARTWIZ

GRADE 10 MATHEMATICS EXAM

MARKS: 100

MARKS	

TIME: 2 hours

SCHOOL _____

CLASS (e.g. 4A) _____

SURNAME _____

NAME _____

Instructions for Learners:

- Read all the instructions carefully before you begin the exam.
- Write your name and learner number clearly on the answer sheet/booklet.
- Answer all the questions unless otherwise instructed.
- Show all your work/calculations where applicable.
- Write neatly and legibly.
- Use only blue or black ink. *Do not use correction fluid or tape.*
- No electronic devices (calculators, phones, etc.) are allowed unless explicitly permitted.
- Raise your hand if you have any questions.
- Do not talk to other learners during the exam.
- Any form of cheating will lead to disqualification.

This test consists of 6 pages including the cover page.

SECTION A: POLYNOMIALS & QUADRATIC EQUATIONS (30 MARKS)

Question 1 (10 marks)
1.1 Expand and simplify:
(2x+3)(x2−x+4)(2x + 3)(x^2 - x + 4)(2x+3)(x2−x+4)

1.2 Given the polynomial P(x)=2x3−3x2+5x−7P(x) = 2x^3 - 3x^2 + 5x - 7P(x)=2x3−3x2+5x−7, find P(2)P(2)P(2).

1.3 Factorise completely:
4x2−254x^2 - 254x2−25

1.4 Solve the quadratic equation by factorisation:
x2+7x+10=0x^2 + 7x + 10 = 0x2+7x+10=0

SECTION B: EXPONENTS AND LOGARITHMS (30 MARKS)

Question 2 (15 marks)
2.1 Simplify:
(34×3−2)÷33(3^4 \times 3^{-2}) \div 3^3(34×3−2)÷33

2.2 Solve for xxx:
2x+1=162^{x+1} = 162x+1=16

2.3 Write in logarithmic form and evaluate:
log⁡5125=?\log_5 125 = ?log5125=?

Question 3 (15 marks)
3.1 Simplify:
(a3b−2)2×a−1b3(a^3 b^{-2})^2 \times a^{-1} b^3(a3b−2)2×a−1b3

3.2 Express 9x+1=272x9^{x+1} = 27^{2x}9x+1=272x as an equation with base 3 and solve for xxx.

SECTION C: TRIGONOMETRY AND CIRCLES (40 MARKS)

Question 4 (20 marks)
4.1 Calculate the height of a tree if its shadow is 12 m long and the angle of elevation of the sun is 60°.
(Use tan⁡60°=3\tan 60° = \sqrt{3}tan60°=3)

4.2 In circle OOO, the radius is 10 cm. Calculate:
a) The circumference (use π=3.14\pi = 3.14π=3.14)

b) The length of an arc subtended by a 72° angle at the center.

4.3 Explain why the angle at the center of a circle is twice the angle at the circumference subtended by the same arc. (2)

Question 5 (20 marks)
5.1 A triangle has sides 7 cm, 24 cm, and 25 cm. Verify if the triangle is right-angled. (Show working)

5.2 Calculate the area of a sector of a circle with radius 14 cm and sector angle 90°. (Use $\pi = 3.14$\pi = 3.14$\pi = 3.14$)

5.3 A kite has diagonals measuring 12 cm and 16 cm. Calculate its area.

TOTAL: 100 MARKS

MEMO

SECTION A: POLYNOMIALS & QUADRATIC EQUATIONS (30 MARKS)

Question 1

1.1 Expand and simplify:

(2x+3)(x2−x+4)=2x·x2+2x·(−x)+2x·4+3·x2+3·(−x)+3·4(2x + 3)(x^2 - x + 4) = 2x \cdot x^2 + 2x \cdot (-x) + 2x \cdot 4 + 3 \cdot x^2 + 3 \cdot (-x) + 3 \cdot 4(2x+3)(x2−x+4)=2x·x2+2x·(−x)+2x·4+3·x2+3·(−x)+3·4
=2x3−2x2+8x+3x2−3x+12= 2x^3 - 2x^2 + 8x + 3x^2 - 3x + 12=2x3−2x2+8x+3x2−3x+12
=2x3+(−2x2+3x2)+(8x−3x)+12=2x3+x2+5x+12= 2x^3 + (-2x^2 + 3x^2) + (8x - 3x) + 12 = 2x^3 + x^2 + 5x + 12=2x3+(−2x2+3x2)+(8x−3x)+12=2x3+x2+5x+12

1.2 Find P(2)P(2)P(2) for P(x)=2x3−3x2+5x−7P(x) = 2x^3 - 3x^2 + 5x - 7P(x)=2x3−3x2+5x−7:

P(2)=2(2)3−3(2)2+5(2)−7=2(8)−3(4)+10−7=16−12+10−7=7P(2) = 2(2)^3 - 3(2)^2 + 5(2) - 7 = 2(8) - 3(4) + 10 - 7 = 16 - 12 + 10 - 7 = 7P(2)=2(2)3−3(2)2+5(2)−7=2(8)−3(4)+10−7=16−12+10−7=7

1.3 Factorise:

4x2−25=(2x)2−52=(2x−5)(2x+5)4x^2 - 25 = (2x)^2 - 5^2 = (2x - 5)(2x + 5)4x2−25=(2x)2−52=(2x−5)(2x+5)

1.4 Solve x2+7x+10=0x^2 + 7x + 10 = 0x2+7x+10=0 by factorisation:

x2+7x+10=(x+5)(x+2)=0x^2 + 7x + 10 = (x + 5)(x + 2) = 0x2+7x+10=(x+5)(x+2)=0

So,

x=−5orx=−2x = -5 \quad \text{or} \quad x = -2x=−5orx=−2

SECTION B: EXPONENTS AND LOGARITHMS (30 MARKS)

Question 2

2.1 Simplify:

(34×3−2)÷33=34+(−2)÷33=32÷33=32−3=3−1=13(3^4 \times 3^{-2}) \div 3^3 = 3^{4 + (-2)} \div 3^3 = 3^{2} \div 3^{3} = 3^{2 - 3} = 3^{-1} = \frac{1}{3}(34×3−2)÷33=34+(−2)÷33=32÷33=32−3=3−1=31

2.2 Solve 2x+1=162^{x+1} = 162x+1=16:

16=24 ⟹ 2x+1=24⇒x+1=4⇒x=316 = 2^4 \implies 2^{x+1} = 2^4 \Rightarrow x + 1 = 4 \Rightarrow x = 316=24⟹2x+1=24⇒x+1=4⇒x=3

2.3 Write in logarithmic form and evaluate:

log⁡5125=?\log_5 125 = ? log5125=?

Since 125=53125 = 5^3125=53,

log⁡5125=3\log_5 125 = 3log5125=3

Question 3

3.1 Simplify:

(a3b−2)2×a−1b3=a3×2b−2×2×a−1b3=a6b−4×a−1b3=a6−1b−4+3=a5b−1=a5b(a^3 b^{-2})^2 \times a^{-1} b^3 = a^{3 \times 2} b^{-2 \times 2} \times a^{-1} b^3 = a^{6} b^{-4} \times a^{-1} b^{3} = a^{6 - 1} b^{-4 + 3} = a^{5} b^{-1} = \frac{a^{5}}{b}(a3b−2)2×a−1b3=a3×2b−2×2×a−1b3=a6b−4×a−1b3=a6−1b−4+3=a5b−1=ba5

3.2 Express and solve 9x+1=272x9^{x+1} = 27^{2x}9x+1=272x with base 3:

9=32,27=339 = 3^2, \quad 27 = 3^39=32,27=33

Rewrite:

(32)x+1=(33)2x ⟹ 32(x+1)=36x(3^2)^{x+1} = (3^3)^{2x} \implies 3^{2(x+1)} = 3^{6x}(32)x+1=(33)2x⟹32(x+1)=36x

So,

2x+2=6x ⟹ 2=6x−2x=4x ⟹ x=122x + 2 = 6x \implies 2 = 6x - 2x = 4x \implies x = \frac{1}{2}2x+2=6x⟹2=6x−2x=4x⟹x=21

SECTION C: TRIGONOMETRY AND CIRCLES (40 MARKS)

Question 4

4.1 Height of tree, using tan⁡60∘=3\tan 60^\circ = \sqrt{3}tan60∘=3:

tan⁡θ=oppositeadjacent⇒height=tan⁡60∘×12=3×12=123≈20.78 m\tan \theta = \frac{\text{opposite}}{\text{adjacent}} \Rightarrow \text{height} = \tan 60^\circ \times 12 = \sqrt{3} \times 12 = 12\sqrt{3} \approx 20.78 \text{ m}tanθ=adjacentopposite⇒height=tan60∘×12=3×12=123 ≈20.78 m

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4.2 Circle with radius 10 cm:

a) Circumference:

C=2πr=2×3.14×10=62.8 cmC = 2 \pi r = 2 \times 3.14 \times 10 = 62.8 \text{ cm}C=2πr=2×3.14×10=62.8 cm

b) Length of arc with 72° angle:

Arc length=θ360∘×2πr=72360×62.8=15×62.8=12.56 cm\text{Arc length} = \frac{\theta}{360^\circ} \times 2 \pi r = \frac{72}{360} \times 62.8 = \frac{1}{5} \times 62.8 = 12.56 \text{ cm}Arc length=360∘θ×2πr=36072×62.8=51×62.8=12.56 cm

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4.3 Explanation:
The angle at the center is twice the angle at the circumference because the arc subtends the central angle directly, while the circumference angle is an inscribed angle that intercepts the same arc, so by the circle theorem, central angle = 2 × inscribed angle.

Question 5

5.1 Check if triangle with sides 7 cm, 24 cm, and 25 cm is right angled:

72+242=49+576=6257^2 + 24^2 = 49 + 576 = 62572+242=49+576=625 252=62525^2 = 625252=625

Since 72+242=2527^2 + 24^2 = 25^272+242=252, triangle is right angled (Pythagorean theorem satisfied).

5.2 Area of sector with radius 14 cm and angle 90°:

Area=θ360∘×πr2=90360×3.14×142=14×3.14×196=153.86 cm2\text{Area} = \frac{\theta}{360^\circ} \times \pi r^2 = \frac{90}{360} \times 3.14 \times 14^2 = \frac{1}{4} \times 3.14 \times 196 = 153.86 \text{ cm}^2Area=360∘θ×πr2=36090×3.14×142=41×3.14×196=153.86 cm2

5.3 Area of kite with diagonals 12 cm and 16 cm:

Area=12×d1×d2=12×12×16=96 cm2\text{Area} = \frac{1}{2} \times d_1 \times d_2 = \frac{1}{2} \times 12 \times 16 = 96 \text{ cm}^2Area=21×d1×d2=21×12×16=96 cm2

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