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: ALGEBRA AND EQUATIONS (30 MARKS)

Question 1 (15 marks)

1.1 Simplify:

3x2y−36x−1y2×4x3y−12y4\frac{3x^2y^{-3}}{6x^{-1}y^2} \times \frac{4x^3y^{-1}}{2y^4}
6x−1y23x2y−3×2y44x3y−1

..... (5)

1.2 Solve for xxx:

2x−13+x+42=5\frac{2x - 1}{3} + \frac{x + 4}{2} = 532x−1+2x+4=5

..... (5)

1.3 Solve the quadratic equation by completing the square:

x2−6x+5=0x^2 - 6x + 5 = 0x2−6x+5=0

..... (5)

Question 2 (15 marks)

2.1 Factorise completely:

4x2−254x^2 - 254x2−25

..... (3)

2.2 Expand and simplify:

(2x−3)(x+5)−(x−1)2(2x - 3)(x + 5) - (x - 1)^2(2x−3)(x+5)−(x−1)2

..... (6)

2.3 Solve the inequality and represent on a number line:

3x+7≥2x+103x + 7 \geq 2x + 103x+7≥2x+10

..... (6)

SECTION B: FUNCTIONS AND GRAPHS (30 MARKS)

Question 3 (15 marks)

3.1 Complete the table for y=2x2−3x+1y = 2x^2 - 3x + 1y=2x2−3x+1:

xxx	**-1**	**0**	**1**	**2**	**3**
yyy					

..... (5)

3.2 Sketch the graph of y=2x2−3x+1y = 2x^2 - 3x + 1y=2x2−3x+1 using the table. Label the vertex and intercepts. (5)

.....
.....
.....

3.3 Determine the coordinates of the vertex of the parabola. (5)

.....
.....

Question 4 (15 marks)

4.1 Given the linear function y=−4x+7y = -4x + 7y=−4x+7:

a) Find the gradient and y-intercept. (3)
.....

b) Calculate the value of yyy when x=2x = 2x=2. (2)
.....

4.2 Find the equation of the line that passes through the points A(1,5)A(1, 5)A(1,5) and B(3,−1)B(3, -1)B(3,−1). (5)
.....
.....

4.3 Determine the point(s) of intersection between y=x2−1y = x^2 - 1y=x2−1 and y=2x+3y = 2x + 3y=2x+3. (5)
.....
.....
.....

SECTION C: GEOMETRY AND MEASUREMENT (40 MARKS)

Question 5 (20 marks)

5.1 A triangle has sides a=8 cma = 8 \text{ cm}a=8 cm, b=15 cmb = 15 \text{ cm}b=15 cm, and the included angle θ=60∘\theta = 60^\circθ=60∘.

a) Calculate the length of side ccc using the cosine rule. (6)
.....
.....

b) Calculate the area of the triangle. (4)
.....
.....

5.2 In circle OOO, the radius is 14 cm.

a) Calculate the circumference. (3)
.....

b) Calculate the length of an arc subtended by an angle of 120∘120^\circ120∘. (3)
.....

c) Calculate the area of the sector formed by the 120∘120^\circ120∘ angle. (4)
.....

Question 6 (20 marks)

6.1 A cylinder has a radius of 5 cm and height 12 cm.

a) Calculate the volume of the cylinder. (4)
.....

b) Calculate the total surface area of the cylinder. (6)
.....

6.2 Convert the following:

a) 3.2 kilometers to meters. (2)
.....

b) 4500 milliliters to liters. (2)
.....

c) 120 square meters to square centimeters. (3)
.....

d) 7.5 hectares to square meters. (3)
.....

TOTAL: 100 MARKS

MEMO

SECTION A: ALGEBRA AND EQUATIONS (30 MARKS)

Question 1

1.1 Simplify:

3x2y−36x−1y2×4x3y−12y4=?\frac{3x^2y^{-3}}{6x^{-1}y^2} \times \frac{4x^3y^{-1}}{2y^4} = ?6x−1y23x2y−3×2y44x3y−1=?

Step 1: Simplify each fraction first:

3x2y−36x−1y2=36×x2−(−1)×y−3−2=12x3y−5\frac{3x^2 y^{-3}}{6x^{-1} y^2} = \frac{3}{6} \times x^{2 - (-1)} \times y^{-3 - 2} = \frac{1}{2} x^{3} y^{-5}6x−1y23x2y−3=63×x2−(−1)×y−3−2=21x3y−5 4x3y−12y4=42×x3×y−1−4=2x3y−5\frac{4 x^3 y^{-1}}{2 y^4} = \frac{4}{2} \times x^3 \times y^{-1 - 4} = 2 x^3 y^{-5}2y44x3y−1=24×x3×y−1−4=2x3y−5

Step 2: Multiply:

(12x3y−5)×(2x3y−5)=1×x3+3×y−5+(−5)=x6y−10\left(\frac{1}{2} x^3 y^{-5}\right) \times \left(2 x^3 y^{-5}\right) = 1 \times x^{3+3} \times y^{-5 + (-5)} = x^6 y^{-10}(21 x3y−5)×(2x3y−5)=1×x3+3×y−5+(−5)=x6y−10

Final answer:

x6y−10=x6y10x^6 y^{-10} = \frac{x^6}{y^{10}}x6y−10=y10x6

1.2 Solve for xxx:

2x−13+x+42=5\frac{2x - 1}{3} + \frac{x + 4}{2} = 532x−1+2x+4=5

Multiply both sides by 6 (LCM of 3 and 2):

2(2x−1)+3(x+4)=302(2x -1) + 3(x + 4) = 302(2x−1)+3(x+4)=30 4x−2+3x+12=304x - 2 + 3x + 12 = 304x−2+3x+12=30 7x+10=307x + 10 = 307x+10=30 7x=207x = 207x=20 x=207x = \frac{20}{7}x=720

1.3 Solve by completing the square:

x2−6x+5=0x^2 - 6x + 5 = 0x2−6x+5=0

Step 1: Move constant to right:

x2−6x=−5x^2 - 6x = -5x2−6x=−5

Step 2: Half coefficient of xxx, square it:

(−62)2=(−3)2=9\left(\frac{-6}{2}\right)^2 = (-3)^2 = 9(2−6)2=(−3)2=9

Add 9 both sides:

x2−6x+9=−5+9x^2 - 6x + 9 = -5 + 9x2−6x+9=−5+9 (x−3)2=4(x - 3)^2 = 4(x−3)2=4

Step 3: Take square roots:

x−3=±2x - 3 = \pm 2x−3=±2 x=3±2x = 3 \pm 2x=3±2 x=5orx=1x = 5 \quad \text{or} \quad x = 1x=5orx=1

Question 2

2.1 Factorise:

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

2.2 Expand and simplify:

(2x−3)(x+5)−(x−1)2(2x - 3)(x + 5) - (x - 1)^2(2x−3)(x+5)−(x−1)2

First expand:

(2x)(x)+(2x)(5)−3(x)−3(5)−(x2−2x+1)(2x)(x) + (2x)(5) - 3(x) - 3(5) - (x^2 - 2x + 1)(2x)(x)+(2x)(5)−3(x)−3(5)−(x2−2x+1) 2x2+10x−3x−15−x2+2x−12x^2 + 10x - 3x - 15 - x^2 + 2x - 12x2+10x−3x−15−x2+2x−1

Simplify terms:

(2x2−x2)+(10x−3x+2x)+(−15−1)=x2+9x−16(2x^2 - x^2) + (10x - 3x + 2x) + (-15 - 1) = x^2 + 9x - 16(2x2−x2)+(10x−3x+2x)+(−15−1)=x2+9x−16

2.3 Solve inequality:

3x+7≥2x+103x + 7 \geq 2x + 103x+7≥2x+10

Subtract 2x2x2x from both sides:

x+7≥10x + 7 \geq 10x+7≥10

Subtract 7:

x≥3x \geq 3x≥3

Number line: All values x≥3x \geq 3x≥3, including 3.

SECTION B: FUNCTIONS AND GRAPHS (30 MARKS)

Question 3

3.1 Complete the table y=2x2−3x+1y = 2x^2 - 3x + 1y=2x2−3x+1:

xxx	-1	0	1	2	3
yyy	6	1	0	3	10

Calculations:

- x=−1:y=2(1)−3(−1)+1=2+3+1=6x=-1: y=2(1) -3(-1)+1=2 +3 +1=6x=−1:y=2(1)−3(−1)+1=2+3+1=6
- x=0:y=0−0+1=1x=0: y=0 - 0 +1=1x=0:y=0−0+1=1
- x=1:y=2−3+1=0x=1: y=2 -3 +1=0x=1:y=2−3+1=0
- x=2:y=8−6+1=3x=2: y=8 -6 +1=3x=2:y=8−6+1=3
- x=3:y=18−9+1=10x=3: y=18 -9 +1=10x=3:y=18−9+1=10

3.2 Graph plotting based on table.
(Students expected to draw and label points, vertex approx at x=34x= \frac{3}{4}x=43, y≈−0.125y \approx -0.125y≈−0.125).

3.3 Vertex formula:

xv=−b2a=−−32×2=34=0.75x_v = -\frac{b}{2a} = -\frac{-3}{2 \times 2} = \frac{3}{4} = 0.75xv=−2ab =−2×2−3=43=0.75 yv=2(0.75)2−3(0.75)+1=2(0.5625)−2.25+1=1.125−2.25+1=−0.125y_v = 2(0.75)^2 - 3(0.75) + 1 = 2(0.5625) - 2.25 + 1 = 1.125 - 2.25 + 1 = -0.125yv =2(0.75)2−3(0.75)+1=2(0.5625)−2.25+1=1.125−2.25+1=−0.125

Vertex: (0.75,−0.125)\boxed{(0.75, -0.125)}(0.75,−0.125)

Question 4

4.1 Given y=−4x+7y = -4x + 7y=−4x+7

a) Gradient = −4-4−4, y-intercept = 7

b) x=2x=2x=2

y=−4(2)+7=−8+7=−1y = -4(2) + 7 = -8 + 7 = -1y=−4(2)+7=−8+7=−1

4.2 Equation of line through points A(1,5)A(1,5)A(1,5) and B(3,−1)B(3,-1)B(3,−1):

Slope:

m=−1−53−1=−62=−3m = \frac{-1 - 5}{3 - 1} = \frac{-6}{2} = -3m=3−1−1−5=2−6=−3

Use point-slope form:

y−5=−3(x−1)y - 5 = -3(x - 1)y−5=−3(x−1) y−5=−3x+3y - 5 = -3x + 3y−5=−3x+3 y=−3x+8y = -3x + 8y=−3x+8

4.3 Intersection between:

y=x2−1y = x^2 - 1y=x2−1

and

y=2x+3y = 2x + 3y=2x+3

Set equal:

x2−1=2x+3x^2 - 1 = 2x + 3x2−1=2x+3 x2−2x−4=0x^2 - 2x - 4 = 0x2−2x−4=0

Use quadratic formula:

x=2±(−2)2−4(1)(−4)2=2±4+162=2±202x = \frac{2 \pm \sqrt{(-2)^2 - 4(1)(-4)}}{2} = \frac{2 \pm \sqrt{4 + 16}}{2} = \frac{2 \pm \sqrt{20}}{2}x=22±(−2)2−4(1)(−4)=22±4+16=22±20 =2±252=1±5= \frac{2 \pm 2\sqrt{5}}{2} = 1 \pm \sqrt{5}=22±25=1±5

Approximate:

x1=1+2.236=3.236,x2=1−2.236=−1.236x_1 = 1 + 2.236 = 3.236, \quad x_2 = 1 - 2.236 = -1.236x1 =1+2.236=3.236,x2=1−2.236=−1.236

Find yyy:

y1=2(3.236)+3=6.472+3=9.472y_1 = 2(3.236) + 3 = 6.472 + 3 = 9.472y1=2(3.236)+3=6.472+3=9.472 y2=2(−1.236)+3=−2.472+3=0.528y_2 = 2(-1.236) + 3 = -2.472 + 3 = 0.528y2 =2(−1.236)+3=−2.472+3=0.528

Points of intersection:

(3.236,9.472),(−1.236,0.528)(3.236, 9.472), (-1.236, 0.528)(3.236,9.472),(−1.236,0.528)

SECTION C: GEOMETRY AND MEASUREMENT (40 MARKS)

Question 5

5.1 Triangle with a=8a=8a=8, b=15b=15b=15, θ=60∘\theta=60^\circθ=60∘:

a) Cosine rule for side ccc:

c2=a2+b2−2abcos⁡θc^2 = a^2 + b^2 - 2ab \cos \thetac2=a2+b2−2abcosθ
c2=82+152−2(8)(15)cos⁡60∘=64+225−240×0.5=289−120=169c^2 = 8^2 + 15^2 - 2(8)(15) \cos 60^\circ = 64 + 225 - 240 \times 0.5 = 289 - 120 = 169c2=82+152−2(8)(15)cos60∘=64+225−240×0.5=289−120=169 c=169=13 cmc = \sqrt{169} = 13 \text{ cm}c=169=13 cm

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b) Area:

Area=12absin⁡θ=12×8×15×sin⁡60∘\text{Area} = \frac{1}{2} ab \sin \theta = \frac{1}{2} \times 8 \times 15 \times \sin 60^\circArea=21absinθ=21×8×15×sin60∘ =60×32=303≈30×1.732=51.96 cm2= 60 \times \frac{\sqrt{3}}{2} = 30 \sqrt{3} \approx 30 \times 1.732 = 51.96 \text{ cm}^2=60×23=303 ≈30×1.732=51.96 cm2

5.2 Circle with radius 14 cm:

a) Circumference:

C=2πr=2×3.14×14=87.92 cmC = 2 \pi r = 2 \times 3.14 \times 14 = 87.92 \text{ cm}C=2πr=2×3.14×14=87.92 cm

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b) Length of arc (120°):

Arc length=120360×2πr=13×87.92=29.31 cm\text{Arc length} = \frac{120}{360} \times 2 \pi r = \frac{1}{3} \times 87.92 = 29.31 \text{ cm}Arc length=360120×2πr=31×87.92=29.31 cm

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c) Area of sector:

Sector area=120360×πr2=13×3.14×142=13×3.14×196=205.3 cm2\text{Sector area} = \frac{120}{360} \times \pi r^2 = \frac{1}{3} \times 3.14 \times 14^2 = \frac{1}{3} \times 3.14 \times 196 = 205.3 \text{ cm}^2Sector area=360120×πr2=31×3.14×142=31×3.14×196=205.3 cm2

Question 6

6.1 Cylinder: radius r=5r=5r=5 cm, height h=12h=12h=12 cm.

a) Volume:

V=πr2h=3.14×25×12=942 cm3V = \pi r^2 h = 3.14 \times 25 \times 12 = 942 \text{ cm}^3V=πr2h=3.14×25×12=942 cm3

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b) Total surface area:

A=2πr(r+h)=2×3.14×5×(5+12)=31.4×17=533.8 cm2A = 2 \pi r (r + h) = 2 \times 3.14 \times 5 \times (5 + 12) = 31.4 \times 17 = 533.8 \text{ cm}^2A=2πr(r+h)=2×3.14×5×(5+12)=31.4×17=533.8 cm2

6.2 Unit conversions:

a) 3.2 km=3.2×1000=3200 m3.2 \text{ km} = 3.2 \times 1000 = 3200 \text{ m}3.2 km=3.2×1000=3200 m

b) 4500 ml=4500÷1000=4.5 L4500 \text{ ml} = 4500 \div 1000 = 4.5 \text{ L}4500 ml=4500÷1000=4.5 L

c) 120 m2=120×10,000=1,200,000 cm2120 \text{ m}^2 = 120 \times 10,000 = 1,200,000 \text{ cm}^2120 m2=120×10,000=1,200,000 cm2

d) 7.5 hectares=7.5×10,000=75,000 m27.5 \text{ hectares} = 7.5 \times 10,000 = 75,000 \text{ m}^27.5 hectares=7.5×10,000=75,000 m2

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