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.

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- 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 NUMBER PATTERNS (30 MARKS)

1.1 Simplify:
$ 4x3y28x2y-1\times 6x-1y33y \left\{ 8x^2y^{-1} \right\} \times \left\{ 6x^{-1}y^3 \right\} \left\{ 3y \right\} \\ 8x2y-14x3y2 \times 3y6x-1y3 $
(4)
1.2 Factorise completely:
8x3-278x^3 - 278x3-27
(3)
1.3 Solve for xxx:
$2x+34=3x-12\frac{2x+3}{4} = \frac{3x-1}{2}42x+3=23x-1$
(3)
Question 2 (10 marks)
2.1 Find the next 3 terms of the sequence and state the type:
3,7,13,21,3, 7, 13, 21, \ldots3,7,13,21, (4)
2.2 Write an expression for the nnn-th term of the sequence above. (3)
2.3 Calculate the sum of the first 10 terms of the sequence. (3)
Question 3 (10 marks) 3.1 Expand and simplify:
$(2x-5)2-(x+1)(x-2)(2x-5)^2 - (x+1)(x-2)(2x-5)2-(x+1)(x-2)$
(5)
3.2 Solve the quadratic equation by completing the square:

$x^{2}+6x^{-7}=0x^{2}+6x-7=0x^{2}+6x^{-7}=0$
(5)
SECTION B: FUNCTIONS, GRAPHS AND COORDINATE GEOMETRY (30 MARKS)
Question 4 (15 marks) 4.1 Draw the graph of $y=2x^2-4x+1y=2x^2-4x+1$ for $x=0,1,2,3x=0,1,2,3x=0,1,2,3$. Complete the table:
xxx 0 1 2 3 yyy
(4)
4.2 Identify the vertex of the parabola. (3)
4.3 Write down the equation of the axis of symmetry. (2)
4.4 Determine the y-intercept. (2)
4.5 Sketch the parabola using the points above. (4)
Question 5 (15 marks) 5.1 Given points A(2,3)A(2, 3)A(2,3) and B(-1 ,7)B(-1 ,7)B(-1 ,7), find:
a) The midpoint of ABABAB. (3)
b) The length of ABABAB. (3)
5.2 Determine the equation of the line passing through points AAA and BBB. (5)
5.3 Find the equation of a line perpendicular to ABABAB and passing through AAA. (4)

SECTION C: TRIGONOMETRY AND GEOMETRY (40 MARKS)

Question 6 (20 marks) 6.1 In triangle PQRPQRPQR, \angle P=35 $^\circ$ \angle P = 35 $^\circ$ \circ \angle P=35 $^\circ$, PQ=10 cmPQ = 10 \text{ cm}PQ=10 cm, PR=15 cmPR = 15 \text{ cm}PR=15 cm.
a) Calculate the length QRQRQR using the cosine rule. (6)
b) Calculate the area of the triangle using the sine rule. (4)
6.2 A circle has a diameter of 20 cm.
a) Calculate the circumference of the circle. (3)
b) Calculate the length of an arc subtending an angle of 45° at the center. (3)
6.3 In a regular hexagon with side length 8 cm:
a) Calculate the perimeter. (2)
b) Calculate the area. (2)
Question 7 (20 marks) 7.1 A cylinder has radius 5 cm and height 12 cm.
a) Calculate the volume of the cylinder. (4)
b) Calculate the total surface area of the cylinder. (5)
7.2 Convert the following:
a) 4500 mm34500 \text{ mm}^34500 mm3 to cm3\text{cm}^3cm3. (2)
b) 2.5 m22.5 \text{ m}^22.5 m2 to cm2\text{cm}^2cm2. (2)
7.3 A rectangle has length 12 cm12 \text{ cm}12 cm and width 7 cm7 \text{ cm}7 cm.

a) Calculate its diagonal. (3)
b) Calculate the angle between the diagonal and the length. (4)

TOTAL: 100 MARKS



MEMO

SECTION A: ALGEBRA AND NUMBER PATTERNS (30 MARKS)

Question 1

1.1

 $4x3y28x2y-1\times 6x-1y33y=48x3-2y2-(-1)\times 63x-1y3-1=12x1y3\times 2x-1y2=(12\times 2)x1-1y3+2=1\times 0y5=y5 \\ ac\{4x^3y^2\}\{8x^2y^{\{-1\}}\} \times \{6x^{\{-1\}}y^3\}\{3y\} = \frac{4}{8}x^{\{3-2\}}y^{\{2-(-1)\}} \\ frac\{6\}\{3\}x^{\{-1\}}y^{\{3-1\}} = \frac{1}{2}x^{\{1\}}y^{\{3\}} \\ frac\{1\}\{2\}x^{\{1\}}y^{\{3\}} \\ frac\{1\}\{2\}x^{\{1\}}y^{\{2\}} \\ frac\{1\}\{2\}x^{\{1\}}y^{\{3\}} \\ frac\{1\}\{2\}x^{\{1\}}y^{\{3\}} \\ frac\{1\}\{2\}x^{\{1\}}y^{\{3\}} \\ frac\{1\}\{2\}x^{\{1\}}y^{\{3\}} \\ frac\{1\}\{2\}x^{\{1\}}y^{\{1\}} \\ frac\{1\}\{2\}x^{\{1\}}y^{\{1\}}$

Answer: y5y^5y5

1.2 8x3-278x^3 - 278x3-27 is a difference of cubes:

 $a3-b3=(a-b)(a2+ab+b2)a^3 - b^3 = (a-b)(a^2+ab+b^2)a^3-b^3 = (a-b)(a2+ab+b2)a^3 - b^3 = (a-b)(a^2+a^2+a^2+b^2)a^3 - b^3 = (a-b)(a^2+a^2+b^2)a^3 - a^2 + a^2 + b^2 + a^2 + a^2$

Here, a=2xa = 2xa=2x, b=3b=3b=3, so:

(2x-3)((2x)2+(2x)(3)+32)=(2x-3)(4x2+6x+9)(2x-3) $big((2x)^2+(2x)(3)+3^2big)=(2x-3)(4x^2+6x+9)(2x-3)((2x)^2+(2x)(3)+3^2big)=(2x-3)(4x^2+6x+9)(2x-3)(4x^2+6x+9)$

Answer: $(2x-3)(4x^2+6x+9)(2x-3)(4x^2+6x+9)(2x-3)(4x^2+6x+9)$

1.3

2x+34=3x-12 $frac{2x + 3}{4} = \frac{3x - 1}{2}42x+3=23x-1$

Multiply both sides by 4:

$$2x+3=2(3x-1)2x+3=2(3x-1)2x+3=2(3x-1)2x+3=6x-22x+3=6x-22x+3=6x-2$$

Bring terms together:

 $3+2=6x-2x \Rightarrow 5=4x3+2=6x-2x \Rightarrow 5=4x = 54=1.25x = \frac{5}{4} = 1.25x=45=1.25$

Answer: $x=54x = \frac{5}{4}x=45$

Question 2

2.1 Sequence: 3, 7, 13, 21, ...

Differences: 4, 6, 8, so second differences are constant (2), so it's quadratic.

Next differences: 10, 12

Next terms: 21 + 10 = 31 31 + 12 = 4343 + 14 = 57

Answer: 31, 43, 57

2.2 Find nnn-th term:

The sequence fits: $Tn=an2+bn+cT_n = an^2 + bn + cT_n=an2+bn+c$ Using terms:

$$T1=3T_1=3T1=3$$
, $T2=7T_2=7T2=7$, $T3=13T_3=13T3=13$

Set up equations:

Subtract first from second:

$$(4a-a)+(2b-b)+(c-c)=7-3 \Rightarrow 3a+b=4(4a-a)+(2b-b)+(c-c)=7-3 \Rightarrow 3a+b=4(4a-a)+(2b-b)+(c-c)=7-3 \Rightarrow 3a+b=4$$

Subtract second from third:

$$(9a-4a)+(3b-2b)+(c-c)=13-7 \Rightarrow 5a+b=6(9a-4a)+(3b-2b)+(c-c)=13-7 \setminus Rightarrow 5a+b=6(9a-4a)+(3b-2b)+(c-c)=13-7 \Rightarrow 5a+b=6$$

Subtract the two:

$$(5a+b)-(3a+b)=6-4 \Rightarrow 2a=2 \Rightarrow a=1(5a+b)-(3a+b)=6-4 \ Rightarrow \ 2a=2 \ Rightarrow \ a=1(5a+b)-(3a+b)=6-4 \Rightarrow 2a=2 \Rightarrow a=1$$

Use 3a+b=43a+b=43a+b=4:

$$3(1)+b=4 \Rightarrow b=13(1)+b=4 \land Rightarrow b = 13(1)+b=4 \Rightarrow b=1$$

Use a+b+c=3a+b+c=3:

$$1+1+c=3 \Rightarrow c=11+1+c=3 \Rightarrow c=1$$

Answer: $Tn=n2+n+1T_n = n^2 + n + 1Tn=n2+n+1$

2.3 Sum of first 10 terms:

 $Sn = \sum_{n=1}^{n=1} 10(n2+n+1) = \sum_{n=1}^{n=1} n2 + \sum_{n=1}^{n=1} 10(n2+n+1) = \sum_{n=1}^{n=1} 10(n2+n+$

Use formulas:

So,

 $S10=385+55+10=450S_{10}=385+55+10=450S10=385+55+10=450$

Answer: 450

Question 3

3.1

 $(2x-5)2-(x+1)(x-2)=(4x2-20x+25)-(x2-x-2)=4x2-20x+25-x2+x+2=3x2-19x+27(2x-5)^2-(x+1)(x-2)=(4x^2-20x+25)-(x^2-x-2)=4x^2-20x+25-x^2+x+2=3x^2-19x+27(2x-5)^2-(x+1)(x-2)=(4x2-20x+25)-(x2-x-2)=4x2-20x+25-x2+x+2=3x^2-19x+27$

Answer: $3x2-19x+273x^2 - 19x + 273x^2-19x+27$

3.2 Complete the square:

$$x^{2}+6x-7=0x^{2}+6x-7=0x^{2}+6x-7=0x^{2}+6x=7x^{2}+6x$$

Add $(62)2=9\left(\frac{6}{2}\right)^2 = 9(26)2=9$ to both sides:

Take square root:

$$x+3=\pm 4x + 3 = pm 4x+3=\pm 4$$

So,

$$x=-3\pm 4x = -3 \text{ } \text{pm } 4x=-3\pm 4$$

Solutions:

x=1 or x=-7 x=1 \quad \text{or} \quad x=-7 x=1 or x=-7

SECTION B

Question 4

4.1 Calculate yyy:

$$y=2x2-4x+1y = 2x^2 - 4x + 1y=2x2-4x+1$$

xxx 0 1 2 3
yyy 1 (2 - 4 + 1) = -1 (8 - 8 + 1) = 1 (18 - 12 + 1) = 7

4.2 Vertex: Use $x=-b2a=44=1x = -\frac{b}{2a} = \frac{4}{4} = 1x = -2ab=44=1$, then y=-1y=-1y=-1 **Answer:** Vertex is (1,-1)(1,-1)(1,-1)

- 4.3 Axis of symmetry: x=1x = 1x=1
- 4.4 y-intercept: $x=0 \Rightarrow y=1 x=0 \ \text{Rightarrow } y=1 x=0 \Rightarrow y=1$

Question 5

- 5.1
- a) Midpoint:

$$(2+(-1)2,3+72)=(12,5)\left(\frac{2+(-1)}{2},\frac{3+7}{2}\right)=\left(\frac{1}{2},\frac{1}{2},\frac{1}{2},\frac{1}{2}\right)=(12,5)\left(\frac{1}{2},\frac{1}{2},\frac{1}{2}\right)=(12,5)\left(\frac{1}{2},\frac{1}{2}\right)=(1$$

b) Length ABABAB:

$$(2-(-1))2+(3-7)2=32+(-4)2=9+16=25=5 \setminus \{(2-(-1))^2+(3-7)^2\} = \setminus \{3^2+(-4)^2\} = \setminus \{(2-(-1))^2+(3-7)^2\} = \setminus \{(2-(-1))^2+(3-(-1))^2\} = \setminus \{(2-(-1))^2+(3-(-1))^2+(3-(-1))^2\} = \setminus \{(2-(-1))^2+(3-(-1))^2+(3-(-1))^2+(3-(-1))^2\} = \setminus \{(2-(-1))^2+(3-(-1)$$

5.2 Gradient mmm:

$$m=7-3-1-2=4-3=-43m = \frac{7-3}{-1-2} = \frac{4}{3}m=-1-27-3=-34=-34$$

Equation using point-slope:

$$y-3=-43(x-2)y-3=-\frac{4}{3}(x-2)y-3=-34(x-2)$$

Or in slope-intercept:

$$y = -43x + 83 + 3 = -43x + 173y = -\left\{4\right\}\left\{3\right\}x + \left\{60, 17\right\}\left\{3\right\}y = -34x + 38 + 3 = -34x + 317$$

5.3 Gradient of perpendicular line:

$$m \perp = 34m_{perp} = \frac{3}{4}m \perp = 43$$

Equation through A(2,3)A(2,3)A(2,3):

$$y-3=34(x-2)y-3=\frac{3}{4}(x-2)y-3=43(x-2)$$

SECTION C

Question 6

6.1

a) Cosine Rule:

QR2=PQ2+PR2-2(PQ)(PR)cos[$\overline{f_0}$]35°QR^2 = PQ^2 + PR^2 - 2(PQ)(PR) \cos 35^\circQR2=PQ2+PR2-2(PQ)(PR)cos35° = $102+152-2\times10\times15\times\cos[\overline{f_0}]$ 35°= $100+225-300\times0.8192=325-245.76=79.24=10^2+15^2-2\times10\times15\times\cos[\overline{f_0}]$ 35°= $100+225-300\times0.8192=325-245.76=79.24=10^2+15^2-2\times10\times15\times\cos35$ °= $100+225-300\times0.8192=325-245.76=79.24$ QR=79.24≈8.9 cmQR = \sqrt{79.24} \approx 8.9 \text{ cm}QR=79.24≈8.9 cm

b) Area:

 $\label{eq:local_action} Area=12PQ\times PR\times \sin[f_0]35\circ=12\times 10\times 15\times 0.574=43.05\ cm2\ text\{Area\} = \frac{1}{2}\ PQ\ times\ PR\ times\ 35^\circ in\ 35^\circ in\ 15^\circ in\ 15^\circ$

6.2

a) Circumference:

 $C = \pi d = \pi \times 20 = 62.83 \text{ cm} C = \pi d = \pi \times 20 = 62.83 \text{ text} cm C = \pi d = \pi \times 20 = 62.83 \text{ cm}$

b) Arc length:

 $l=45360\times62.83=18\times62.83=7.85$ cml = $\frac{45}{360}$ \times $62.83=\frac{1}{8}$ \times 62.83=7.85 \text{ cm} $l=36045\times62.83=81\times62.83=7.85$ cm

6.3

a) Perimeter hexagon:

 $6\times8=48$ cm6 \times 8=48 \text{ cm} $6\times8=48$ cm

b) Area hexagon:

 $Area=332s2=3\times1.7322\times82=2.598\times64=166.27\ cm2\ text{Area} = \frac{3 \ sqrt{3}}{2}\ s^2 = \frac{3 \times 1.732}{2} \times 8^2 = 2.598 \times 64 = 166.27 \times cm^2 \times 8^2 = 2.598 \times 64 = 166.27 \times cm^2 \times 8^2 = 2.598 \times 64 = 166.27 \times 64 = 166.27$

Question 7

7.1

a) Volume cylinder:

 $V = \pi r^2 h = \pi \times 52 \times 12 = \pi \times 25 \times 12 = 942.48 \text{ cm} 3V = \pi^2 h =$

b) Surface area cylinder:

 $SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 5(5+12)=10\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi \times 17=534.07 \text{ cm} \\ 2SA=2\pi r(r+h)=2\pi r(r+$

7.2

a) $4500 \text{ mm}3=4.5 \text{ cm}34500 \text{ text} \text{ mm}^3 = 4.5 \text{ cm}^34500 \text{ mm}3=4.5 \text{ cm}3 \text{ (since } 1 \text{ cm}3=1000 \text{ mm}31 \text{ text} \text{ cm}^3 = 1000 \text{ text} \text{ mm}^31 \text{ cm}3=1000 \text{ mm}3)$

b) $2.5 \text{ m2}=2.5\times10,000=25,000 \text{ cm}22.5 \text{ \text{ m}^2}= 2.5 \text{ \text{ m} \node 2}= 2.5,000 \text{ \text{ cm}^2}= 10,000 \text{ cm}21 \text{ \text{ m}^2}= 10,000 \text{ \text{ cm}}^2= 10,000 \text{ cm}21 \text{ \text{ m}^2}= 10,000 \text{ \text{ cm}}^2= 10,000 \text{ cm}2)}$

7.3

a) Diagonal rectangle:

 $d=122+72=144+49=193=13.89 \text{ cmd} = \sqrt{12^2+7^2} = \sqrt{144+49} = \sqrt{193} = 13.89 \text{ text} = \sqrt{122+72} = \sqrt{144+49} = \sqrt{193} = 13.89 \text{ text} = \sqrt{122+72} = \sqrt{144+49} = \sqrt{193} = 13.89 \text{ text} = \sqrt{193} = \sqrt{193} = 13.89 \text{ text} = \sqrt$

b) Angle θ \theta θ between diagonal and length:

 $cos[\underline{fo}]\theta = adjacenthy potenuse = 1213.89 = 0.864 \\ cos \\ \text{adjacent} \} \\ \text{hypotenuse}\} = \\ \text{12} \\ \{13.89\} = 0.864 \\ \text{cos}\theta = hypotenuse adjacent} = 13.8912 = 0.864 \\ \theta = cos[\underline{fo}] - 1(0.864) = 30 \\ \text{hypotenuse}\} = \\ \text{1} \\ \{0.864\} = 30 \\ \text{cos} - 1(0.864) = 30 \\ \text$

TOTAL: 100

