

SMARTWIZ

GRADE11 MATHEMATICS EXAM

MARKS: 100

TIME: 2 HOURS

SCHOOL _____

CLASS (eg. 4A) _____

SURNAME _____

NAME _____

MARKS	
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Instructions for Learners:

- Read all instructions carefully before you begin the exam.
- Write your full name and student number clearly on the answer sheet/book.
- Answer all questions unless otherwise instructed.
- Show all your work/calculations where necessary.
- Write neatly and clearly.
- Use only a blue or black pen. Do not use correction fluid or tape.
- Electronic devices (calculators, cell phones, etc.) are not 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 result in immediate disqualification from the exam.

This exam consists of six pages, including the cover page.

SECTION A: FUNCTIONS AND GRAPHING (20 marks)

1. The function $f(x) = 3x^2 - 2x + 5$.

a) Find $f(4)$.

b) Find $f(-1)$.

c) Sketch the graph of $f(x)$ for $x = -2, -1, 0, 1, 2$. Fill the table below:

x	-2	-1	0	1	2
$f(x)$					

2. Determine whether the function $g(x) = \frac{2x+3}{x-1}$ has any asymptotes. If yes, state them clearly.

SECTION B: TRIGONOMETRY AND CIRCLES (20 marks)

3. In triangle ABC, where $\angle C = 90^\circ$, $AB = 13$ cm, and $BC = 5$ cm, find the length of side AC.

4. Find the exact values of $\sin 45^\circ$, $\cos 60^\circ$, and $\tan 30^\circ$.

$\sin 45^\circ =$ $\cos 60^\circ =$ $\tan 30^\circ =$

5. The equation of a circle is given by:

$$(x-3)^2 + (y+2)^2 = 25$$

a) Find the coordinates of the center and the radius of the circle.

b) Does the point $(6,1)$ lie inside, on, or outside the circle? Justify your answer.

SECTION C: LOGARITHMS AND EXPONENTIALS (20 marks)

6. Solve for x :

$$3^{2x-1} = 81^{3^{2x-1}} = 81$$

7. Express $\log_2 240 - \log_2 25 + 2\log_2 3$ as a single logarithm.

8. If $y = e^{3x}$, find $\frac{dy}{dx}$.

SECTION D: SEQUENCES AND SERIES (15 marks)

9. The first term of a geometric sequence is 5 and the common ratio is 2.

a) Write down the explicit formula for the n th term T_n .

b) Find the 6th term T_6 .

c) Calculate the sum of the first 6 terms S_6 .

SECTION E: DIFFERENTIATION AND APPLICATIONS (25 marks)

10. Differentiate the following functions with respect to x :

a) $y = 4x^3 - 5x + 2$

b) $y = \frac{7}{x^2}$

c) $y = \sin(2x)$

11. The position of a particle is given by:

$$s(t) = t^3 - 6t^2 + 9t$$

a) Find the velocity $v(t) = \frac{ds}{dt}$

b) Find the acceleration $a(t) = \frac{d^2s}{dt^2}$

c) Determine the time t when the particle changes direction.

END OF EXAM

TOTAL : 100

MEMO

SECTION A: FUNCTIONS AND GRAPHING

$$1a. f(4)=3(4)^2-2(4)+5=3(16)-8+5=48-8+5=45 \quad f(4)=3(4)^2-2(4)+5=3(16)-8+5=48-8+5=45$$

$$1b. f(-1)=3(-1)^2-2(-1)+5=3(1)+2+5=10 \quad f(-1)=3(-1)^2-2(-1)+5=3(1)+2+5=10$$

1c. Calculate $f(x)f(x)f(x)$:

xxx	-2	-1	0	1	2
f(x)f(x)f(x)	3(4)+4+5=213(4)+4+5=213(4)+4+5=21	10	5	6	13

Calculations:

- $f(-2)=3(4)-2(-2)+5=12+4+5=21$
 $21f(-2)=3(4)-2(-2)+5=12+4+5=21$
- $f(-1)=10$ (already calculated)
- $f(0)=3(0)-0+5=5$
 $5f(0)=3(0)-0+5=5$
- $f(1)=3(1)-2+5=6$
 $6f(1)=3(1)-2+5=6$
- $f(2)=3(4)-4+5=13$
 $13f(2)=3(4)-4+5=13$

2. Asymptotes of $g(x)=\frac{2x+3}{x-1}$:

- Vertical asymptote where denominator = 0:

$$x-1=0 \Rightarrow x-1=0 \Rightarrow x=1$$

- Horizontal asymptote (degree numerator = degree denominator):
Divide leading terms coefficients:

$$y=\frac{2x}{x}=2$$

Answer:

Vertical asymptote at $x=1$

Horizontal asymptote at $y=2$

SECTION B: TRIGONOMETRY AND CIRCLES

3. Using Pythagoras theorem:

$$AC = \sqrt{AB^2 - BC^2} = \sqrt{13^2 - 5^2} = \sqrt{169 - 25} = \sqrt{144} = 12 \text{ cm}$$

4. Exact values:

$$\sin 45^\circ = \frac{\sqrt{2}}{2}, \cos 45^\circ = \frac{\sqrt{2}}{2}, \sin 60^\circ = \frac{\sqrt{3}}{2}, \cos 60^\circ = \frac{1}{2}, \tan 30^\circ = \frac{1}{\sqrt{3}}, \tan 60^\circ = \sqrt{3}$$

5a. Circle center and radius:

$$\text{Center } (h, k) = (3, -2), \text{ Radius } r = \sqrt{25} = 5$$

5b. Check if (6,1) lies inside/on/outside:

Calculate distance from center to point:

$$d = \sqrt{(6-3)^2 + (1+2)^2} = \sqrt{3^2 + 3^2} = \sqrt{18} = 3\sqrt{2} \approx 4.24$$

Since $d = 4.24 < 5$, point lies **inside** the circle.

SECTION C: LOGARITHMS AND EXPONENTIALS

6. Solve $3^{2x-1} = 81$:

Note $81 = 3^4$, so:

$$3^{2x-1} = 3^4 \implies 2x-1 = 4 \implies 2x = 5 \implies x = \frac{5}{2} = 2.5$$

7. Simplify logarithm expression:

$$\log_2 40 - \log_2 5 + 2 \log_2 3 = \log_2 \frac{40}{5} + \log_2 3^2 = \log_2 8 + \log_2 9 = \log_2 (8 \times 9) = \log_2 72$$

8. Differentiate $y = e^{3x}$:

$$\frac{dy}{dx} = 3e^{3x}$$

SECTION D: SEQUENCES AND SERIES

9a. Explicit formula:

$$T_n = ar^{n-1} = 5 \times 2^{n-1} \quad T_n = ar^{n-1} = 5 \times 2^{n-1}$$

9b. Sixth term:

$$T_6 = 5 \times 2^5 = 5 \times 32 = 160 \quad T_6 = 5 \times 2^5 = 5 \times 32 = 160$$

9c. Sum of first 6 terms:

$$S_6 = ar - 1r - 1 = 5 \times 2^6 - 1 = 5 \times (64 - 1) = 5 \times 63 = 315 \quad S_6 = a \frac{r^n - 1}{r - 1} = 5 \times \frac{2^6 - 1}{2 - 1} = 5 \times (64 - 1) = 5 \times 63 = 315$$

SECTION E: DIFFERENTIATION AND APPLICATIONS

10a. Differentiate $y = 4x^3 - 5x + 2$: $y = 4x^3 - 5x + 2$:

$$\frac{dy}{dx} = 12x^2 - 5 \quad \frac{dy}{dx} = 12x^2 - 5$$

10b. Differentiate $y = 7x^{-2}$: $y = \frac{7}{x^2} = 7x^{-2}$:

$$\frac{dy}{dx} = 7 \times (-2)x^{-3} = -14x^{-3} = -\frac{14}{x^3} \quad \frac{dy}{dx} = 7 \times (-2)x^{-3} = -14x^{-3} = -\frac{14}{x^3}$$

10c. Differentiate $y = \sin(2x)$: $y = \sin(2x)$:

Use chain rule:

$$\frac{dy}{dx} = 2 \cos(2x) \quad \frac{dy}{dx} = 2 \cos(2x)$$

11a. Velocity $v(t) = \frac{ds}{dt}$: $v(t) = \frac{ds}{dt}$:

$$v(t) = 3t^2 - 12t + 9 \quad v(t) = 3t^2 - 12t + 9$$

11b. Acceleration $a(t) = \frac{d^2s}{dt^2}$: $a(t) = \frac{d^2s}{dt^2}$:

$$a(t)=6t-12 \quad a(t) = 6t - 12 \quad a(t)=6t-12$$

11c. Particle changes direction when velocity = 0:

$$3t^2-12t+9=0 \quad 3t^2 - 12t + 9 = 0 \quad 3t^2-12t+9=0$$

Divide by 3:

$$t^2-4t+3=0 \quad t^2 - 4t + 3 = 0 \quad t^2-4t+3=0$$

Factor:

$$(t-3)(t-1)=0 \implies t=1,3 \quad (t-3)(t-1)=0 \implies t=1,3$$

END OF MEMO

TOTAL : 100

MYST PATHWORKS