



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

MATHEMATICS

(First paper)

NQF LEVEL 3

XX February 2020

This marking guideline consists of 9 pages.

QUESTION 1

1.1 1.1.1 $(-1 + 2i)\{(1 - 5i) + (3 + 4i)\}$
 $= (-1 + 2i)(4 - i) \checkmark$
 $= -4 + i + 8i - 2i^2 \checkmark$ (carry forward mistake from the
 $= -4 + 9i + 2$ previous line)
 $= -2 + 9i \checkmark$ (3)

1.1.2 $\frac{1}{(2 + 3i)} \times \frac{1}{(1 - 2i)}$
 $= \frac{1}{2 - 4i + 3i - 6i^2} \checkmark$
 $= \frac{1}{8 - i} \times \frac{8 + i}{8 + i} \checkmark$ (carry forward incorrect
 $= \frac{8 + i}{8 + i} \checkmark$ denominator)
 $= \frac{8}{65} + \frac{1}{65}i \checkmark$
 $= 0,123 + 0,015i$ (4)

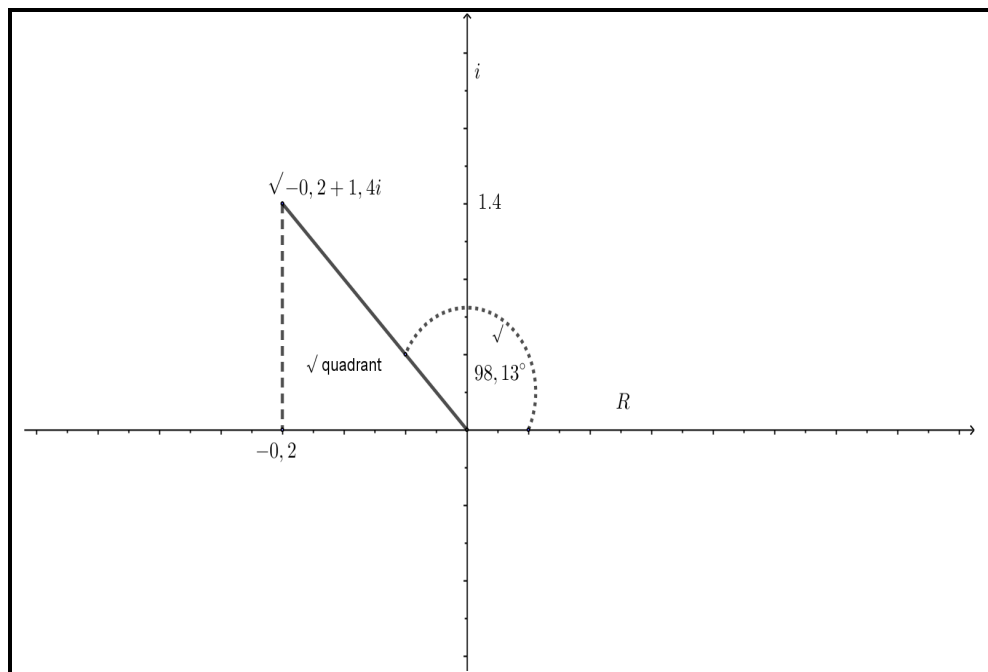
1.1.3 $12(\cos 45^\circ + i \sin 45^\circ) \times 20(\cos 120^\circ + i \sin 120^\circ)$
 $= 240 \checkmark (\cos 165^\circ + i \sin 165^\circ) \checkmark$ (2)

1.1.4 $(2 + 5i)2 + 5(7 + 2i) - i(4 - 6i)$
 $= 4 + 10i + 35 + 10i - 4i + 6i^2 \checkmark$
 $= 33 + 16i \checkmark$ (carry forward mistake from the previous line) (2)

1.2 1.2.1 $\frac{5 + 5i}{3 - 4i} \times \frac{3 + 4i}{3 + 4i} \checkmark$
 $= \frac{15 + 20i + 15i + 20i^2}{9 - 16i^2} \checkmark$
 $= \frac{-5 + 35i}{25} \checkmark$
 $= -\frac{1}{5} + \frac{7}{5}i$
 $= -0,2 + 1,4i \checkmark$ (4)

1.2.2 $-0,2 + 1,4i$
 $r = \sqrt{(-0,2)^2 + (1,4)^2} \checkmark$ (carry forward mistake from 1.2.1)
 $r = \sqrt{2} \checkmark = 1,414$
 $\theta = \tan^{-1}\left(\frac{1,4}{-0,2}\right)$
 $ref = 81,87^\circ \checkmark$
 $\theta = 180^\circ - 81,87^\circ$
 $\theta = 98,13^\circ \checkmark$ (4)

1.2.3



(3)

1.3

$$\begin{aligned} & \frac{(3|150^\circ)}{(2|30^\circ)(0,5|10^\circ)} \\ &= \frac{3|150^\circ}{1|40^\circ} \checkmark \\ &= 3|110^\circ \checkmark \\ &= -1,026 + 2,819i \checkmark \end{aligned}$$

(3)

1.4

$$\begin{aligned} & 5x^2 + 2x + 10 = 0 \\ & x = \frac{-(2) \pm \sqrt{(2)^2 - 4(5)(10)}}{2(5)} \checkmark \\ &= \frac{-2 \pm \sqrt{-196}}{10} \checkmark \\ &= \frac{-2 \pm \sqrt{196}i}{10} \checkmark \\ &= \frac{-2}{10} + \frac{14}{10}i \checkmark \text{ or } \frac{-2}{10} - \frac{14}{10}i \checkmark \\ &= -0,2 + 1,4i \text{ or } -0,2 - 1,4i \end{aligned}$$

(5)
 [30]

QUESTION 2

$$\begin{aligned}
 2.1 \quad & 4x^2 - 3 = 2x \\
 & x^2 - \frac{1}{2}x = \frac{3}{4} \quad \checkmark \\
 & x^2 - \frac{1}{2}x + \left(\frac{1}{4}\right)^2 = \frac{3}{4} + \left(\frac{1}{4}\right)^2 \quad \checkmark \\
 & \left(x - \frac{1}{4}\right)^2 = \frac{13}{16} \\
 & x = \frac{1}{4} \pm \sqrt{\frac{13}{16}} \quad \checkmark \\
 & x = \frac{1 + \sqrt{13}}{4} \text{ or } \frac{1 - \sqrt{13}}{4} \\
 & x = 1,151 \text{ or } -0,651 \quad \checkmark \text{ (accept 1,152 or -0,652)} \quad (4)
 \end{aligned}$$

$$\begin{aligned}
 2.2 \quad & 2z^2 = 7z - 6 \\
 & 2z^2 - 7z + 6 = 0 \\
 & z = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(2)(6)}}{2(2)} \quad \checkmark \\
 & z = \frac{7 \pm \sqrt{49 - 48}}{4} \\
 & z = \frac{7 \pm 1}{4} \quad \checkmark \\
 & z = 2 \quad \checkmark \text{ or } z = \frac{3}{2} \quad \checkmark \text{ or } 1,5 \quad (4)
 \end{aligned}$$

$$\begin{aligned}
 2.3 \quad & 3x^2 - 8x - 4 > 8 \\
 & 3x^2 - 8x + 4 > 0 \\
 & (3x - 2)(x - 2) > 0 \quad \checkmark \checkmark \\
 & \therefore x < \frac{2}{3} \quad \checkmark \text{ or } x > 2 \quad \checkmark \quad (4)
 \end{aligned}$$

$$\begin{aligned}
 2.4 \quad 2.4.1 \quad & \frac{28x - 14}{45x - 30} \div \frac{14x + 7}{30x - 20} \\
 & = \frac{14(2x - 1)}{15(3x - 2)} \quad \checkmark \times \frac{10(3x - 2)}{7(2x + 1)} \quad \checkmark \\
 & = \frac{140(2x - 1)}{105(2x + 1)} \quad \checkmark \\
 & = \frac{4(2x - 1)}{3(2x + 1)} \quad \checkmark \quad (4)
 \end{aligned}$$

$$\begin{aligned}
 2.4.2 \quad & \frac{x-2}{x} - \frac{x}{x-4} \\
 & \frac{(x-2)(x-4) - x^2}{x(x-4)} \quad \checkmark \\
 & \frac{x^2 - 6x + 8 - x^2}{x(x-4)} \quad \checkmark \\
 & \frac{-6x + 8}{x(x-4)} \quad \checkmark \\
 & \frac{-2(3x-4)}{x(x-4)}
 \end{aligned}$$

(4)
[20]**QUESTION 3**

$$\begin{aligned}
 3.1 \quad 3.1.1 \quad & r(x) = x^2 \sqrt[3]{x^2} \\
 & r = x^2 x^{\frac{2}{3}} \quad \checkmark \\
 & r = x^{\frac{8}{3}} \quad \checkmark \\
 & r' = \frac{8}{3} x^{\frac{5}{3}} \\
 & r' = \frac{8 \sqrt[3]{x^5}}{3} \quad \checkmark
 \end{aligned}$$

(3)

$$\begin{aligned}
 3.1.2 \quad & y = \frac{-x^3}{3} + \frac{x^2}{2} + x - 6 \\
 & y' = -x^2 \quad \checkmark + x \quad \checkmark + 1 \quad \checkmark + 0 \quad \checkmark
 \end{aligned}$$

(4)

$$\begin{aligned}
 3.1.3 \quad & f(x) = (3x)^{-4} \\
 & f(x) = 3^{-4} x^{-4} \\
 & f(x) = \frac{1}{81} x^{-4} \quad \checkmark \\
 & f' = \frac{-4}{81x^5} \quad \checkmark
 \end{aligned}$$

(2)

$$\begin{aligned}
 3.2 \quad y &= \frac{1}{x} \\
 f(x+h) &= \frac{1}{(x+h)} \\
 f' &= \lim_{h \rightarrow 0} \frac{\frac{1}{(x+h)} - \frac{1}{x}}{h} \checkmark \\
 f' &= \lim_{h \rightarrow 0} \frac{\frac{x-x-h}{x(x+h)}}{h} \checkmark \\
 f' &= \lim_{h \rightarrow 0} \frac{-h}{x(x+h)} \cdot \frac{1}{h} \\
 f' &= \lim_{h \rightarrow 0} \frac{-1}{x(x+h)} \checkmark \\
 f' &= -\frac{1}{x^2} \checkmark
 \end{aligned} \tag{4}$$

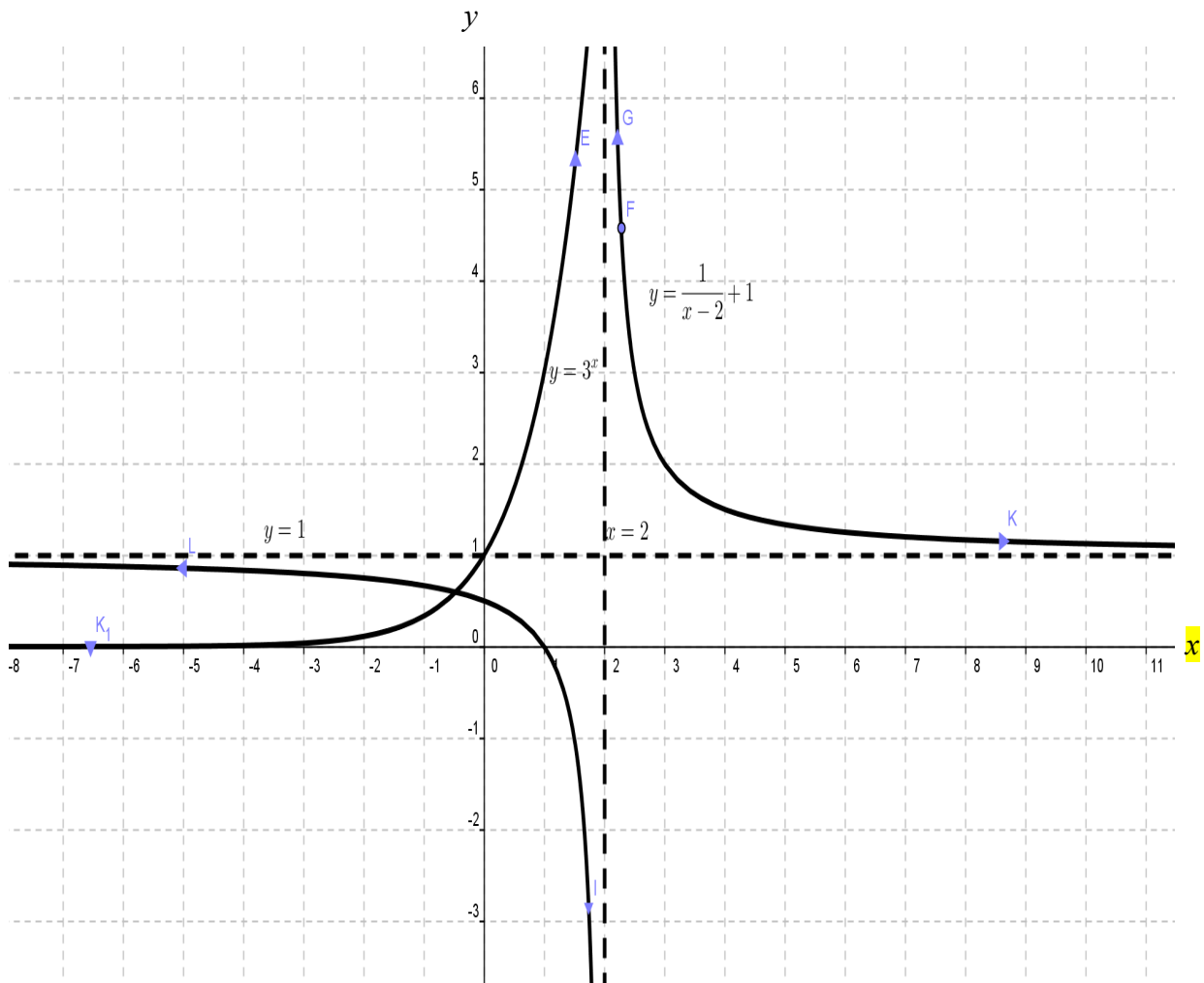
$$\begin{aligned}
 3.3 \quad \lim_{x \rightarrow \infty} \frac{-4x}{7x-3} \\
 &= \lim_{x \rightarrow \infty} \frac{\frac{-4x}{x}}{\frac{7x}{x} - \frac{3}{x}} \checkmark \\
 &= \lim_{x \rightarrow \infty} \frac{-4}{7 - \frac{3}{x}} \\
 &= \frac{-4}{7-0} \checkmark \\
 &= \frac{-4}{7} \checkmark
 \end{aligned} \tag{3}$$

$$\begin{aligned}
 3.4 \quad &\text{Let one number be } x \therefore \text{the other number } x - 4 \\
 &P = x(x - 4) \checkmark \\
 &P = x^2 - 4x \\
 &P' = 2x - 4 \checkmark \\
 &P' = 0 \\
 &2x - 4 = 0 \\
 &x = 2 \checkmark \\
 &\text{the other number is } 2 - 4 = -2 \checkmark
 \end{aligned} \tag{4}$$

[20]

QUESTION 4

4.1



TWO marks for drawing $y = 3^x$ correctly

- ✓ for x -intercept
- ✓ not touching the x axis as well as shape

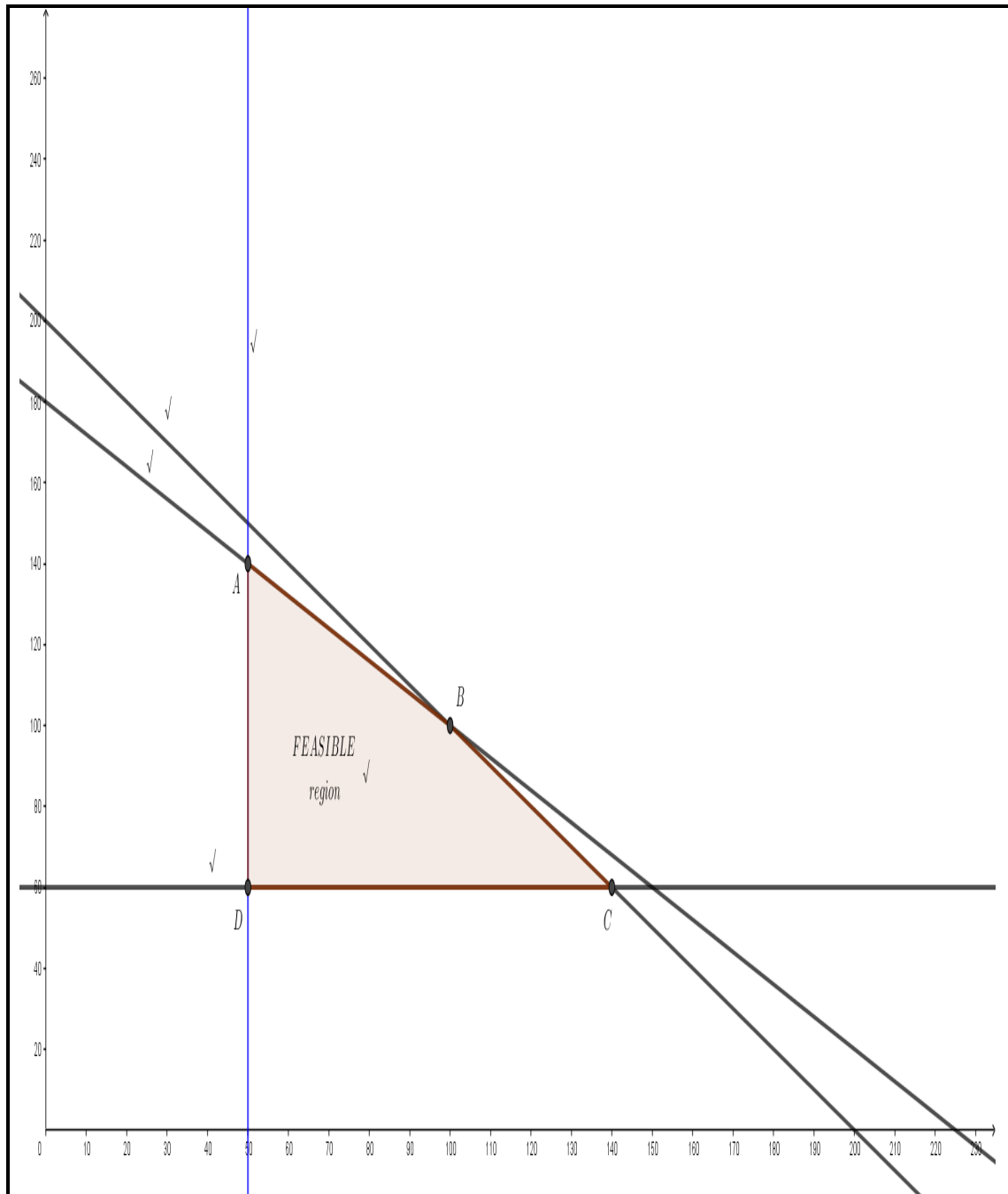
FOUR marks for drawing $y = \frac{1}{x-2} + 1$ correctly

- ✓ for correct x asymptote
- ✓ for correct y asymptote
- ✓ for correct x -intercept
- ✓ for correct shape

(6)

4.2	4.2.1	$y = ax^2 + bx + c; c = 0$ $4,5 = a(-3)^2 + b(-3) [-3; 4,5]$ $4,5 = 9a - 3b (\times 2)$ $2 = a(2)^2 + b(2) [2; 2]$ $2 = 4a + 2b (\times 3)$ ✓ $9 = 18a - 6b$ equation 1 $6 = 12a + 6b$ equation 2 $15 = 30a$ $a = \frac{1}{2}$ ✓ <i>substitute:</i> $2 = 4\left(\frac{1}{2}\right) + 2b$ $2 = 2 + 2b$ $0 = 2b$ $b = 0$ ✓ $\therefore y = \frac{1}{2}x^2$ ✓	Alternate method Equation of a parabola $y = a(x - p)^2 + q$ ✓ Substitute $y = a(x - 0)^2 + 0$ ✓ $y = ax^2$ Substitute a point (2;2) $2 = a(2)^2$ $a = \frac{1}{2}$ ✓ $\therefore y = \frac{1}{2}x^2$ ✓	(4)
	4.2.2	$y = mx + c$ $m = \frac{(4,5 - 2)}{(-3 - 2)}$ ✓ $m = -\frac{1}{2}$ ✓ $c = 3$ on graph ✓ $\therefore y = -\frac{1}{2}x + 3$ ✓		(4)
	4.2.3	Continuous		(1)
	4.2.4	A function		(1)
	4.2.5	Domain: $g(x): \{x: x \in R\}$		(2)
	4.2.6	Range of $f(x) = \{y: y \geq 0; y \in R\}$		(2)

4.3 4.3.1



(4)

4.3.2 See graph.

(1)

4.3.3 $A(50; 140) \therefore P = 0,3(50) + 0,5(140) = 85 \checkmark$
 $B(100; 100) \therefore P = 0,3(100) + 0,5(100) = 80 \checkmark$
 $C(140; 60) \therefore P = 0,3(140) + 0,5(60) = 72 \checkmark$
 $D(50; 60) \therefore P = 0,3(50) + 0,5(60) = 45 \checkmark$
 $D(50; 60)$ wil minimise profit \checkmark

(5)
 [30]

TOTAL: 100