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.

Copyright reserved

QUESTION 1

1.1 1.1.1

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

1.1.2

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

1.1.3

$12(cos45° + isin45°) \times 20(cos120° + isin120°)$
$= 240$ ✓ $(cos165° + isin\ 165°)$ ✓ (2)

1.1.4

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

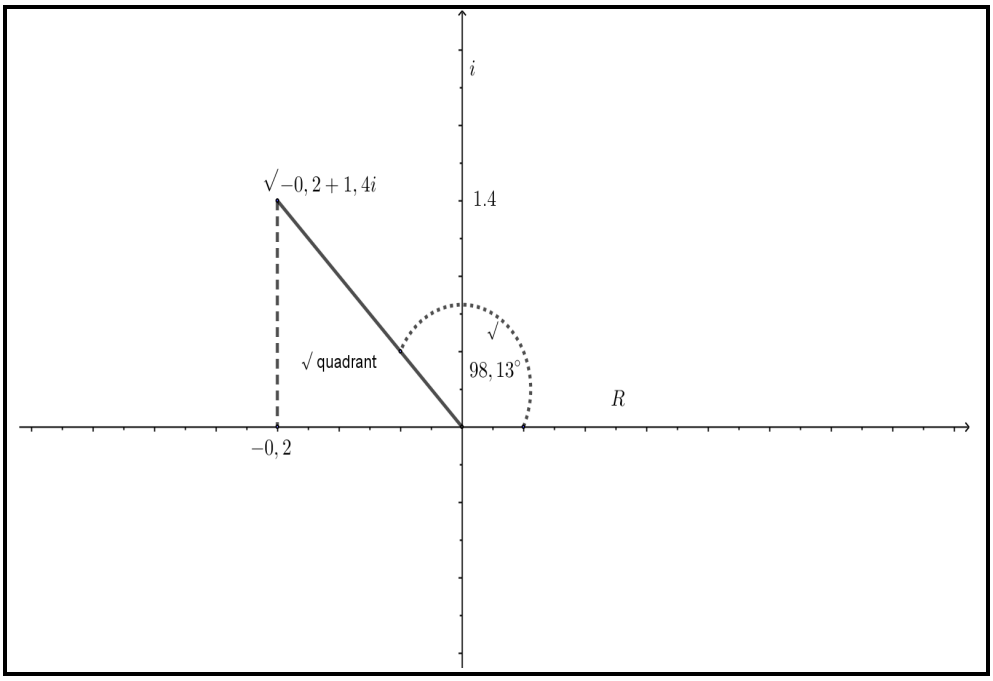
1.2 1.2.1

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

1.2.2

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

1.2.3



(3)

1.3 $\dfrac{(3\underline{|150°}}{(2\underline{|30°})(0,5\underline{|10°})}$

$= \dfrac{3\underline{|150°}}{1\underline{|40°}}$ ✓

$= 3\underline{|110°}$ ✓

$= -1,026 + 2,819i$ ✓ (3)

1.4 $5x^2 + 2x + 10 = 0$

$x = \dfrac{-(2) \pm \sqrt{(2)^2 - 4(5)(10)}}{2(5)}$ ✓

$= \dfrac{-2 \pm \sqrt{-196}}{10}$ ✓

$= \dfrac{-2 \pm \sqrt{196}i}{10}$ ✓

$= \dfrac{-2}{10} + \dfrac{14}{10}i$ ✓ or $\dfrac{-2}{10} - \dfrac{14}{10}i$ ✓

$= -0,2 + 1,4i \quad or - 0,2 - 1,4i$ (5)

[30]

QUESTION 2

2.1 $4x^2 - 3 = 2x$

$x^2 - \frac{1}{2}x = \frac{3}{4}$ ✓

$x^2 - \frac{1}{2}x + (\frac{1}{4})^2 = \frac{3}{4} + (\frac{1}{4})^2$ ✓

$(x - \frac{1}{4})^2 = \frac{13}{16}$

$x = \frac{1}{4} \pm \sqrt{\frac{13}{16}}$ ✓

$x = \frac{1+\sqrt{13}}{4}$ *or* $\frac{1-\sqrt{13}}{4}$

x = 1,151 or − 0,651 ✓(accept 1,152 or -0,652) (4)

2.2 $2z^2 = 7z - 6$

$2z^2 - 7z + 6 = 0$

$z = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(2)(6)}}{2(2)}$ ✓

$z = \frac{7 \pm \sqrt{49-48}}{4}$

$z = \frac{7 \pm 1}{4}$ ✓

$z = 2$ ✓ *or* $z = \frac{3}{2}$ ✓ or 1,5 (4)

2.3 $3x^2 - 8x - 4 > 8$

$3x^2 - 8x + 4 > 0$

$(3x-2)(x-2) > 0$ ✓✓

$\therefore x < \frac{2}{3}$ ✓ *or* $x > 2$ ✓ (4)

2.4 2.4.1 $\frac{28x-14}{45x-30} \div \frac{14x+7}{30x-20}$

$= \frac{14(2x-1)}{15\cancel{(3x-2)}}$ ✓ $\times \frac{10\cancel{(3x-2)}}{7(2x+1)}$ ✓

$= \frac{140(2x-1)}{105(2x+1)}$ ✓

$= \frac{4(2x-1)}{3(2x+1)}$ ✓ (4)

2.4.2 $\frac{x-2}{x}-\frac{x}{x-4}$

$$=\frac{(x-2)(x-4)-x^2}{x(x-4)} \quad ✓ ✓$$

$$=\frac{x^2-6x+8-x^2}{x(x-4)} \quad ✓$$

$$=\frac{-6x+8}{x(x-4)} \quad ✓$$

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

(4)
[20]

QUESTION 3

3.1 3.1.1

$$r(x)=x^2\sqrt[3]{x^2}$$

$$r=x^2x^{\frac{2}{3}} \quad ✓$$

$$r=x^{\frac{8}{3}} \quad ✓$$

$$r'=\frac{8}{3}x^{\frac{5}{3}}$$

$$r'=\frac{8\sqrt[3]{x^5}}{3} \quad ✓$$

(3)

3.1.2

$$y=\frac{-x^3}{3}+\frac{x^2}{2}+x-6$$

$$y'=-x^2✓+x✓+1✓+0✓$$

(4)

3.1.3

$$f(x)=(3x)^{-4}$$

$$f(x)=3^{-4}x^{-4}$$

$$f(x)=\frac{1}{81}x^{-4}✓$$

$$f'=\frac{-4}{81x^5} \quad ✓$$

(2)

3.2 $y = \frac{1}{x}$

$f(x+h) = \frac{1}{(x+h)}$

$f' = \lim_{h \to 0} \frac{\frac{1}{(x+h)} - \frac{1}{x}}{h}$ ✓

$f' = \lim_{h \to 0} \frac{\frac{x - x - h}{x(x+h)}}{h}$ ✓

$f' = \lim_{h \to 0} \frac{-h}{x(x+h)} . \frac{1}{h}$

$f' = \lim_{h \to 0} \frac{-1}{x(x+h)}$ ✓

$f' = -\frac{1}{x^2}$ ✓ (4)

3.3 $\lim_{x \to \infty} \frac{-4x}{7x - 3}$

$= \lim_{x \to \infty} \frac{\frac{-4x}{x}}{\frac{7x}{x} - \frac{3}{x}}$ ✓

$= \lim_{x \to \infty} \frac{-4}{7 - \frac{3}{x}}$

$= \frac{-4}{7 - 0}$ ✓

$= \frac{-4}{7}$ ✓ (3)

3.4 Let one number be $x \therefore the\ other\ number\ x - 4$

$P = x(x-4)$ ✓

$P = x^2 - 4x$

$P' = 2x - 4$ ✓

$P' = 0$

$2x - 4 = 0$

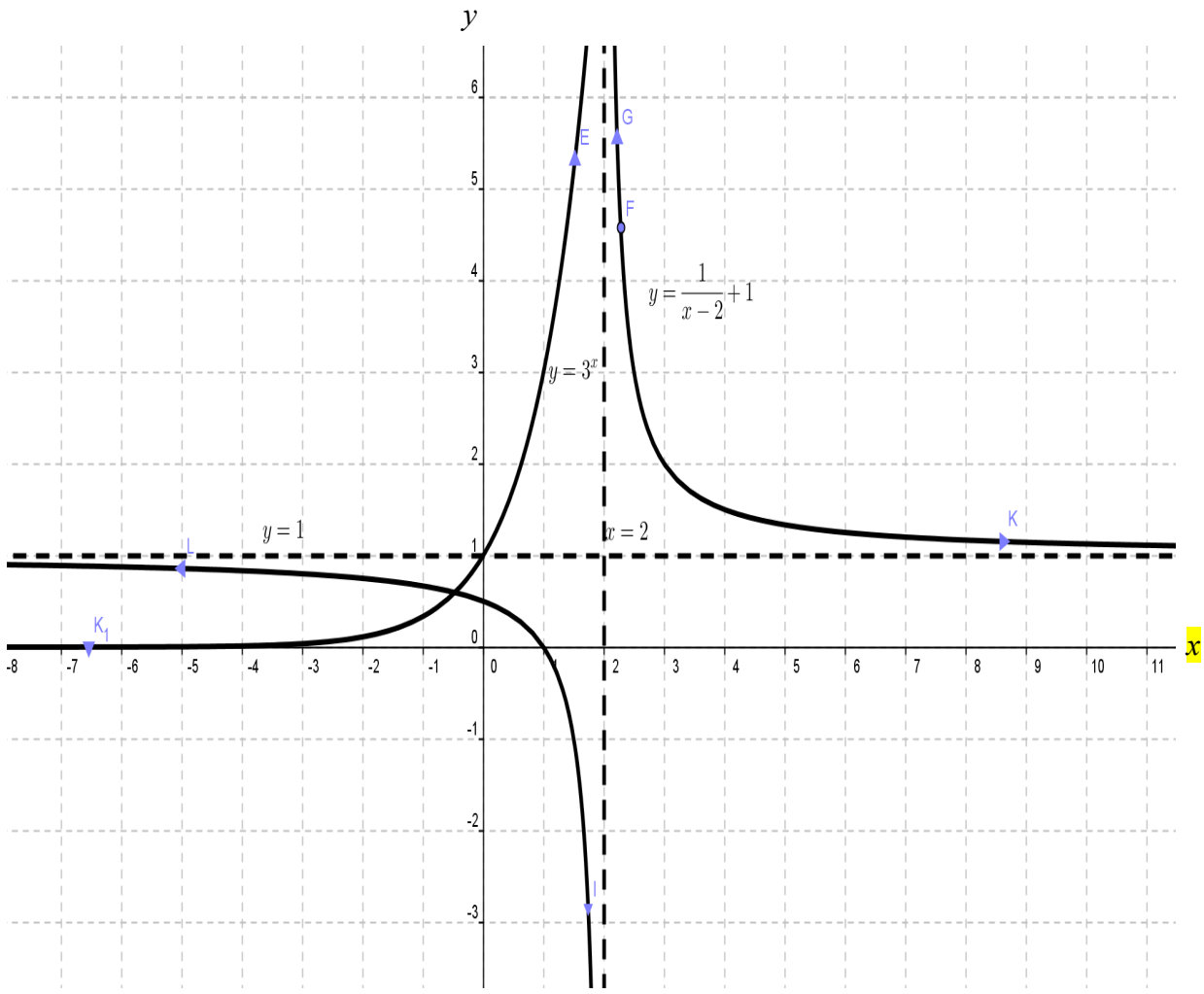
$x = 2$ ✓

$the\ other\ number\ is\ 2 - 4 = -2$ ✓ (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

$y = ax^2 + bx + c; c = 0$
$4{,}5 = a(-3)^2 + b(-3)\ [-3; 4{,}5]$
$4{,}5 = 9a - 3b\ (\times 2)$
$2 = a(2)^2 + b(2)\ \ [2; 2]$
$\underline{2 = 4a + 2b\ (\times 3)}$ ✓
$9 = 18a - 6b\ equation\ 1$
$\underline{6 = 12a + 6b\ equation\ 2}$
$15 = 30a$
$a = \frac{1}{2}$ ✓
$substitute: 2 = 4\left(\frac{1}{2}\right) + 2b$
$2 = 2 + 2b$
$0 = 2b$
$b = 0$ ✓
$\therefore y = \frac{1}{2}x^2$ ✓

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)

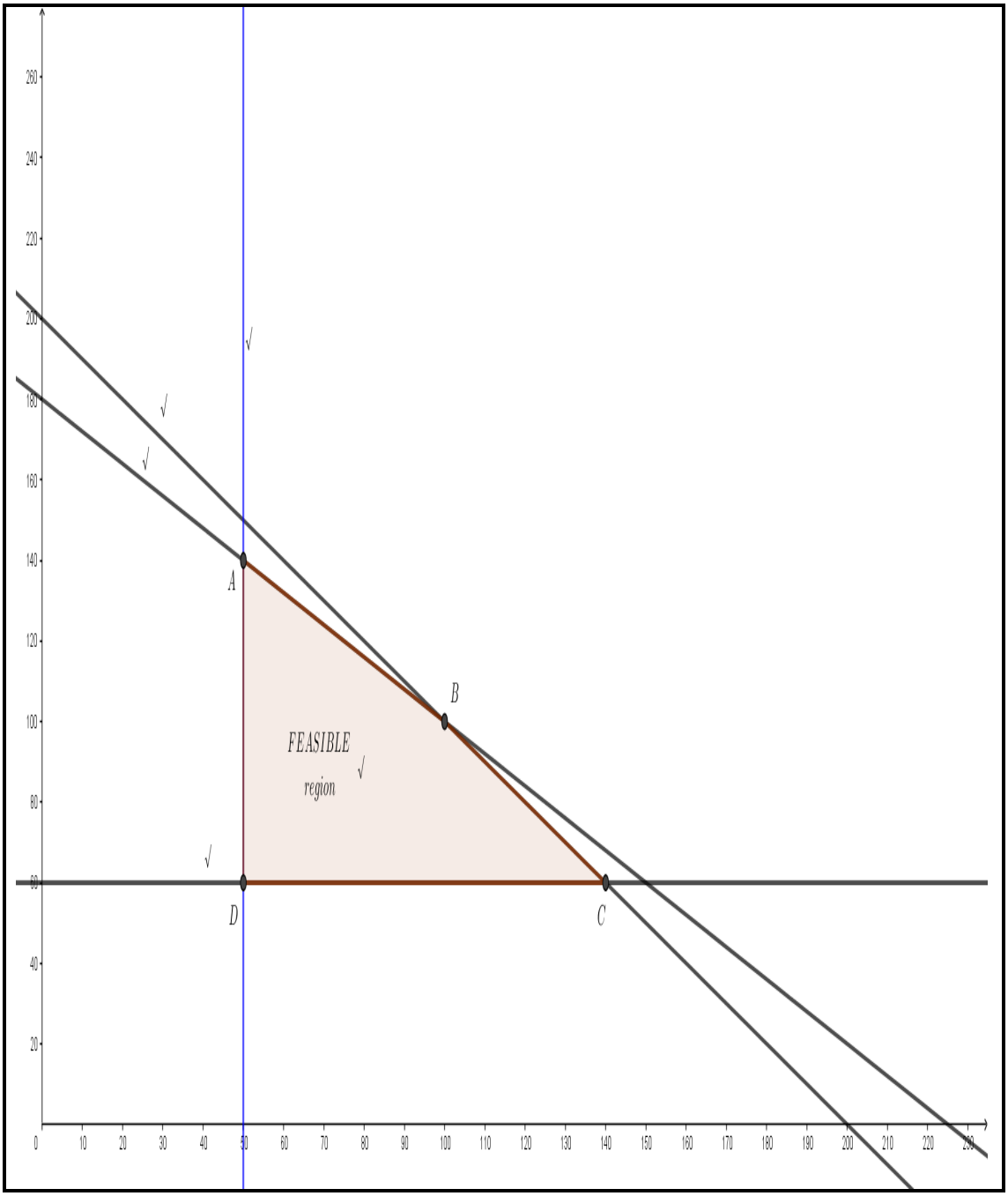
4.2.3 Continuous (1)

4.2.4 A function (1)

4.2.5 Domain: $g(x): \{x: x \epsilon R\}$ (2)

4.2.6 Range of $f(x) = \{y: y \geq 0; y \epsilon R\}$ (2)

4.3 4.3.1



(4)

4.3.2 See graph. (1)

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

[30]

TOTAL: 100

Copyright reserved