



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

WISKUNDE N5

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Hierdie nasienriglyn bestaan uit 11 bladsye.

VRAAG 1

1.1

$$y = \lim_{x \rightarrow \infty} \frac{3x^2 + e^x}{4x^3 + 5x} \quad \frac{\infty}{\infty}$$

$$= \lim_{x \rightarrow \infty} \frac{6x + e^x}{12x^2 + 5} \quad \frac{\infty}{\infty} \checkmark$$

$$= \lim_{x \rightarrow \infty} \frac{6 + e^x}{24x} \quad \frac{\infty}{\infty} \checkmark$$

$$= \lim_{x \rightarrow \infty} \frac{e^x}{24} \checkmark$$

$$= \infty \checkmark$$

(4)

1.2

$$f(x) = \sec x = \frac{1}{\cos x}$$

$$\cos x = 0$$

$$x = 90^\circ \checkmark \text{ or } x = 270^\circ \checkmark$$

(2)

[6]

VRAAG 2

2.1

2.1.1

$$y = \ln^3 [x^2 - 5x + \sqrt{x^2 - 7x + 20}]$$

$$\frac{dy}{dx} = 3 \ln^2 [x^2 - 5x + \sqrt{x^2 - 7x + 20}] \checkmark$$

$$\times \frac{1}{x^2 - 5x + \sqrt{x^2 - 7x + 20}} \checkmark$$

$$\times \left[2x - 5 \checkmark + \frac{1}{2} (x^2 - 7x + 20)^{-\frac{1}{2}} \checkmark \right] \times (2x - 7) \checkmark$$

(5)

2.1.2

$$y = \sec^{-1}(x^2) + \tan^{-1} \left(\frac{1-x}{1+x} \right)$$

$$\frac{dy}{dx} = \frac{1}{\sqrt{x^4 - 1}} \checkmark \times 2x \checkmark \times \frac{1}{1 + \left(\frac{1-x}{1+x} \right)^2} \checkmark \times \frac{(1+x)(-1) - (1-x) \checkmark}{(1+x)^2 \checkmark}$$

(5)

2.2 $y = 3^{x \ln x^2}$

$$\ln y = x \ln x^2 \ln 3$$

$$\frac{1}{y} \frac{dy}{dx} \checkmark = \ln x^2 \ln 3 \checkmark + 2 \ln 3 \checkmark$$

$$\frac{dy}{dx} = y [\ln x^2 \ln 3 + 2 \ln 3] \checkmark$$

$$= 3^{x \ln x^2} [\ln x^2 \ln 3 + 2 \ln 3] \quad (4)$$

2.3 2.3.1 $x^2 y + \cos\left(\frac{\pi}{2} y\right) - 4x^2 = 5$

$$2xy + x^2 \frac{dy}{dx} - \sin\left(\frac{\pi}{2} y\right) \times \frac{\pi}{2} \times \frac{dy}{dx} - 8x = 0 \checkmark$$

$$\frac{dy}{dx} \left(x^2 - \frac{\pi}{2} \sin\left(\frac{\pi}{2} y\right) \right) = 8x - 2xy \checkmark$$

$$\frac{dy}{dx} = - \frac{8x - 2xy}{x^2 - \frac{\pi}{2} \sin\left(\frac{\pi}{2} y\right)} \checkmark \quad (3)$$

2.3.2 $\frac{dy}{dx} = \frac{8 \times 1 - 2 \times 1 \times 2}{2^2 - \frac{\pi}{2} \sin\left(\frac{\pi}{2} \times 2\right)} = 1 \checkmark$

$$y = 1x + c$$

$$2 = 1(1) + c$$

$$c = 1 \checkmark$$

$$y = x + 1 \checkmark$$

(3)
[20]

VRAAG 3

3.1 3.1.1 $f(x) = x^3 - 3x + 5$

$$f'(x) = 3x^2 - 3 = 0 \checkmark$$

$$x = -1 \text{ or } x = 1$$

$$y = 7 \quad y = 3 \checkmark$$

Die koördinate van die draaipunte is dus $(-1; 7)$ en $(1; 3)$. $\checkmark$

(3)

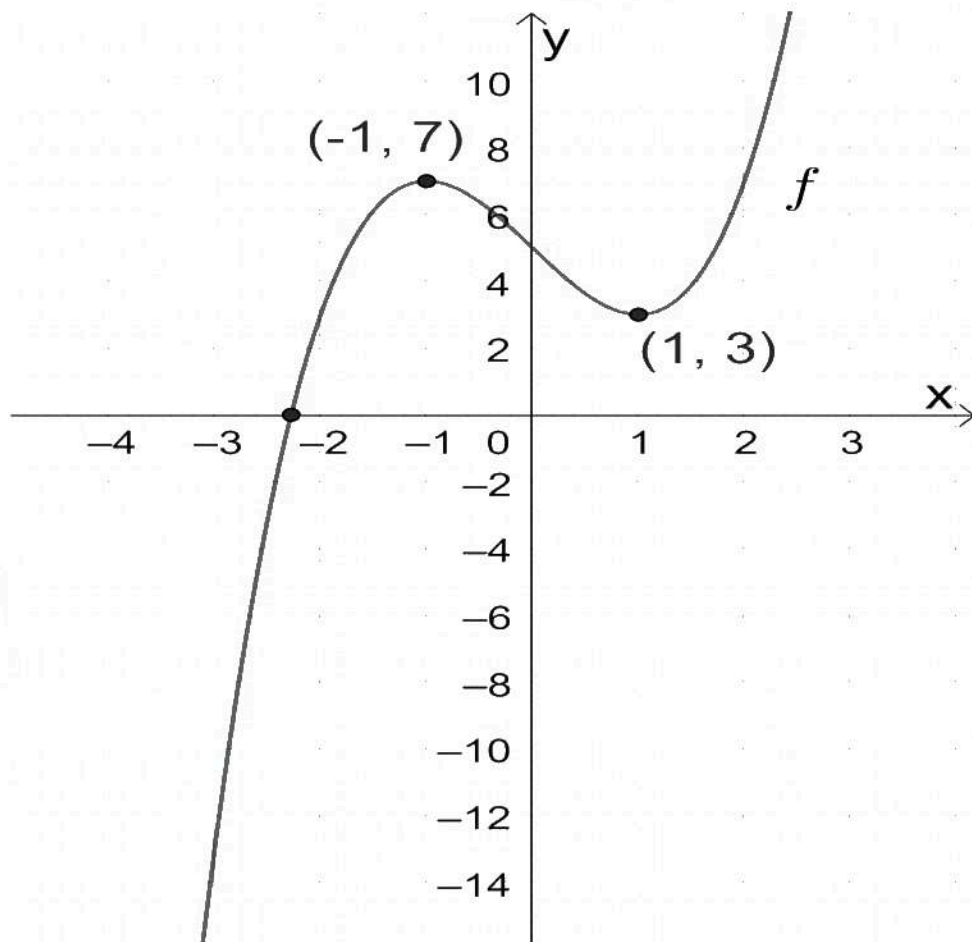
3.1.2

x	-3	-2	-1	0	1	2
y	-13	3	7	5	3	7

$\checkmark\checkmark = 1$ punt vir elke 3 korrekte antwoorde

(2)

3.1.3



$\checkmark = 1$ punt vir die vorm

$\checkmark = 1$ punt vir die aanduiding van die draaipunte op die grafiek

(2)

3.1.4 Laat $x_0 = -2,3$

$$f(-2,3) = -0,267$$

$$f'(-2,3) = 12,87 \checkmark$$

$$x_1 = -2,3 + \frac{0,267}{12,87} \checkmark$$

$$= -2,279 \checkmark$$

$$f(-2,279) = -0,003$$

$$f'(-2,279) = 12,585$$

$$x_2 = -2,279 + \frac{0,003}{12,585}$$

$$= -2,279 \checkmark$$

(4)

3.2

3.2.1

$$s = \frac{1}{3}t^3 - 2t^2 + 3t$$

$$s = \frac{1}{3}(2)^3 - 2(2)^2 + 3(2) \checkmark$$

$$= \frac{2}{3} \text{ m } \checkmark$$

(2)

3.2.2

$$s = \frac{1}{3}t^3 - 2t^2 + 3t$$

$$s' = t^2 - 4t + 3 \checkmark$$

$$s'(4) = 3 \text{ m/s } \checkmark$$

(2)

3.2.3

$$s = \frac{1}{3}t^3 - 2t^2 + 3t = 0$$

$$t(t-3)^2 = 0 \checkmark$$

$$t = 0 \text{ s } \checkmark \text{ en } t = 3 \text{ s } \checkmark$$

(3)

3.2.4

$$s'' = 2t - 4 \checkmark$$

$$s''(4) = 4 \text{ m/s}^2 \checkmark$$

(2)

[20]

VRAAG 4

4.1 4.1.1

$$\int \frac{x(2-3x)}{e^{3x} + x^2} dx$$

$$\begin{aligned} \text{let } u &= 1 + x^2 e^{-3x} \\ \frac{du}{dx} &= x e^{-3x} (2 - 3x) \\ dx &= \frac{1}{x e^{-3x} (2 - 3x)} du \checkmark \end{aligned}$$

$$= \int \frac{x(2-3x)}{e^{3x} + x^2} \times \frac{1}{x e^{-3x} (2 - 3x)} du$$

$$= \int \frac{1}{1 + x^2 e^{-3x}} du \checkmark$$

$$= \int \frac{1}{u} du$$

$$= \ln u + C$$

$$= \ln(1 + x^2 e^{-3x}) + C \checkmark \quad (3)$$

4.1.2 $y = \cos^7 x \sin^3 x$ (4)

$$= \int \cos^7 x (1 - \cos^2 x) \sin x dx \checkmark$$

$$= \int (\cos^7 x - \cos^9 x) \sin x dx$$

$$\text{let } u = \cos x$$

$$- du = \sin x dx \checkmark$$

$$= \int (u^9 - u^7) du$$

$$= \frac{u^{10}}{10} - \frac{u^8}{8} + C$$

$$= \frac{\cos^{10} x}{10} \checkmark - \frac{\cos^8 x}{8} \checkmark + C$$

$$\begin{aligned}
 4.1.3 \quad & \int \cos\left(\frac{\pi}{2}x\right) \sin\left(\frac{\pi}{4}x\right) dx \\
 &= \int \frac{1}{2} \left(\sin \frac{3\pi}{4}x - \sin \frac{\pi}{4}x \right) dx \checkmark \\
 &= -\frac{2}{3\pi} \cos \frac{3\pi}{4}x \checkmark + \frac{2}{\pi} \cos \frac{\pi}{4}x \checkmark + c
 \end{aligned} \tag{3}$$

$$\begin{aligned}
 4.1.4 \quad & \int \frac{2x^3 - 5x^2 + 6x + 12}{x - 4} dx \\
 &= \int \left(2x^2 + 3x + 18 + \frac{84}{x - 4} \right) dx \checkmark \\
 &= \frac{2}{3}x^3 \checkmark + \frac{3}{2}x^2 \checkmark + 18x \checkmark + 84 \ln(x - 4) \checkmark + C
 \end{aligned} \tag{5}$$

$$4.1.5 \quad \int 4x \cos 4x \, dx$$

$ \begin{aligned} \text{laat } u &= 4x & dv &= \cos 4x \, dx \\ du &= 4 \, dx & v &= \frac{1}{4} \sin 4x \checkmark \end{aligned} $
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$$\begin{aligned}
 \int x \cos 4x \, dx &= 4x \sin 4x - \int \sin 4x \, dx \checkmark \\
 &= x \sin 4x \checkmark + \frac{1}{4} \cos 4x \checkmark + C
 \end{aligned} \tag{4}$$

$$\begin{aligned}
 4.2 \quad & \int \frac{x - 5}{x^2 + 5x + 4} \\
 & \frac{x - 5}{(x + 1)(x + 4)} = \frac{A}{x + 1} + \frac{B}{x + 4} \\
 & x - 5 = A(x + 4) + B(x + 1) \checkmark
 \end{aligned}$$

$ \begin{aligned} \text{laat } x &= -4; & B &= 3 \checkmark \\ \text{or} \\ x &= -1; & A &= -2 \checkmark \end{aligned} $

$$\begin{aligned}
 &= \int \left(\frac{-2}{x + 1} + \frac{3}{x + 4} \right) dx \\
 &= -2 \ln(x + 1) \checkmark + 3 \ln(x + 4) \checkmark + C
 \end{aligned} \tag{5}$$

VRAAG 5

$$5.1 \quad = \int_0^{\infty} \frac{7}{3} t e^{-st} dt \checkmark$$

laat $u = t$ en $dv = e^{-st} dt$

$$du = 1dt \text{ en } v = -\frac{1}{s} e^{-st} \checkmark$$

$$= \frac{7}{3} \left(-\frac{t}{s} e^{-st} + \frac{1}{s} \int e^{-st} dt \right) \checkmark$$

$$= \frac{7}{3} \lim_{a \rightarrow \infty} \left[-\frac{t}{s} e^{-st} - \frac{1}{s^2} e^{-st} \right]_0^a \checkmark$$

$$= \frac{7}{3} \left((0 - 0) + \frac{1}{s^2} \right)$$

$$= \frac{7}{3s^2} \checkmark$$

(5)

$$5.2 \quad 5.2.1 \quad 1 - x = \sqrt{1 - x^2}$$

$$1 - 2x + x^2 = 1 - x^2$$

$$2x^2 - 2x = 0$$

$$2x(x - 1) = 0 \checkmark$$

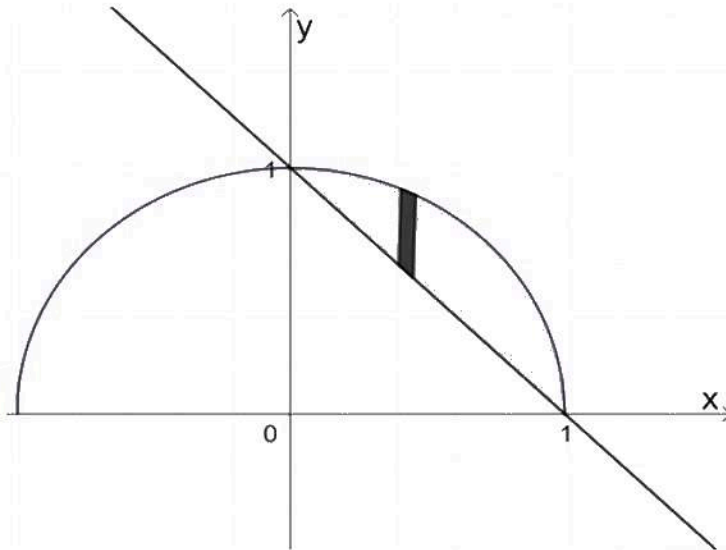
$$x = 0 \quad \text{or} \quad x = 1$$

$$y = 1 \quad y = 0 \checkmark$$

Die koördinate van die snypunte vir die ingeslote oppervlakte is dus (0; 1) en (1; 0) $\checkmark$.

(3)

5.2.2



✓ = 1 punt vir aanduiding van elke ingeslote oppervlakte

✓ = 1 punt vir aanduiding van die vertikale of horisontale strook

(2)

5.2.3

$$A = \int_a^b (y_1 - y_2) dx$$

$$= \int_0^1 [\sqrt{1-x^2} - (1-x)] dx \checkmark$$

$$= \left[\frac{1}{2} \sin^{-1} x + \frac{x}{2} \sqrt{1-x^2} - x + \frac{1}{2} x^2 \right]_0^1 \checkmark$$

$$= 0,285 \text{ eenhede}^2 \checkmark$$

(3)

5.2.4

$$V = \pi \int_a^b (y_1^2 - y_2^2) dx$$

$$= \pi \int_0^1 [(\sqrt{1-x^2})^2 - (1-x)^2] dx \checkmark$$

$$= \pi \int_0^1 (2x - 2x^2) dx \checkmark$$

$$= \pi \left[x^2 - \frac{2}{3} x^3 \right]_0^1 \checkmark$$

$$= \frac{\pi}{3} \text{ or } 1,047 \text{ eenhede}^3 \checkmark$$

$$\begin{aligned}
 5.3 \quad m &= \sigma = \frac{m}{A} = \frac{m}{\pi r^2} \\
 dm &= \sigma dA = \frac{m}{\pi r^2} dA \\
 dI_z &= (\text{afstand})^2 dm \\
 &= x^2 \frac{m}{\pi r^2} dA \checkmark \\
 &= x^2 \times \frac{m}{\pi r^2} \times 2\pi x dx \checkmark \\
 I &= \frac{2m}{r^2} \int_0^r x^3 dx \checkmark \\
 &= \frac{2m}{r^2} \left[\frac{x^4}{4} \right]_0^r \checkmark \\
 &= \frac{1}{2} mr^2 \text{ eenhede}^4 \checkmark
 \end{aligned}$$

(5)
[22]

VRAAG 6

$$\begin{aligned}
 6.1 \quad \frac{dy}{dx} &= \frac{3}{y \cos^2 x} \\
 y dy &= 3 \sec^2 x dx \checkmark \\
 \frac{1}{2} y^2 \checkmark &= 3 \tan x + C \checkmark \\
 \frac{1}{2} (2)^2 &= 3 \tan 45^\circ + C \\
 C &= -1 \checkmark \\
 \therefore \frac{1}{2} y^2 &= 3 \tan x - 1 \checkmark
 \end{aligned}$$

(5)

6.2

$$\cos x \frac{d^2 y}{dx^2} = \sin 2x + 2^{3x} \cdot \cos x$$

$$\frac{d^2 y}{dx^2} = 2 \sin x + 2^{3x} \checkmark$$

$$\frac{dy}{dx} = -2 \cos x + \frac{2^{3x}}{3 \ln 2} + A \checkmark$$

$$y = -2 \sin x + \frac{2^{3x}}{9 \ln^2 2} + Ax + B \checkmark$$

(3)

[8]

TOTAAL: 100