NASIONALE SENIOR SERTIFIKAAT-EKSAMEN
MEI 2025

WISKUNDE: VRAESTEL I

NASIENRIGLYNE

Tyd: 3 uur 150 punte

Hierdie nasienriglyne is opgestel vir gebruik deur eksaminators en hulp-eksaminators van wie verwag word om almal 'n standaardiseringsvergadering by te woon om te verseker dat die riglyne konsekwent vertolk en toegepas word by die nasien van kandidate se skrifte.

Die IEB sal geen bespreking of korrespondensie oor enige nasienriglyne voer nie. Ons erken dat daar verskillende standpunte oor sommige aangeleenthede van beklemtoning of detail in die riglyne kan wees. Ons erken ook dat daar sonder die voordeel van die bywoning van 'n standaardiseringsvergadering verskillende vertolkings van die toepassing van die nasienriglyne kan wees.

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AFDELING A

VRAAG 1

(a) (1) $a = 34$

$d = -9$

$\therefore T_{16} = 34 + (15)(-9)$

$= -101$

(2) $S_{128} = \frac{128}{2}[2(34) + 127(-9)]$

$= -68\ 800$

(b) $\sum_{n=0}^{1} p^{3n} = 1001$

$p^{3(0)} + p^{3(1)} = 1001$

$\therefore p^0 + p^3 = 1001$

$\therefore p^3 = 1000$

$\therefore p = 10$

(c) (1) 20 ; 27

(2) $2a = -2$

$\therefore a = -1$

$3(-1) + b = 13$

$\therefore b = 16$

$(-1) + (16) + c = -13$

$\therefore c = -28$

$T_n = -n^2 + 16n - 28$

(3) $n = -\frac{b}{2a}$

$= -\frac{16}{2(-1)}$

$= 8$

OF

$\frac{dT_n}{dn} = -2n + 16 = 0$

$\therefore 2n = 16$

$\therefore n = 8$

OF

–13 ; 0 ; 11 ; 20 ; 27 ; 32 ; 35 ; 36 ; 35 ; 32 ; …

$\therefore n = 8$

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VRAAG 2

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

$$= \lim_{h \to 0} \frac{5(x+h)^2 - 5x^2}{h}$$
$$= \lim_{h \to 0} \frac{5x^2 + 10xh + 5h^2 - 5x^2}{h}$$
$$= \lim_{h \to 0} \frac{h(10x + 5h)}{h}$$
$$= \lim_{h \to 0} (10x + 5h)$$
$$= 10x$$

(b) (1) $$y = \sqrt{x} + \frac{1}{x^3} + 1$$

$$= x^{\frac{1}{2}} + x^{-3} + 1$$
$$\therefore \frac{dy}{dx} = \frac{1}{2}x^{-\frac{1}{2}} - 3x^{-4}$$

(2) $$D_x\left(\frac{x^2 - 25}{x - 5}\right)$$

$$= D_x\left(\frac{(x-5)(x+5)}{x-5}\right)$$
$$= D_x(x + 5)$$
$$= 1$$

(c) $$k(x) = x^3 + 6x^2 - 7$$

$$\therefore k'(x) = 3x^2 + 12x$$
$$\therefore k''(x) = 6x + 12$$
$$\therefore 6x + 12 > 0$$
$$\therefore 6x > -12$$
$$\therefore x > -2$$

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VRAAG 3

(a) $b = \frac{8}{-8}$

$\therefore b = -1$

(b) $x \neq 0 \quad x \in \mathbb{R}$

(c) $y = x$
$y = -x$

(d) $x > 0$

(e) (1) $y = -\frac{8}{x}$

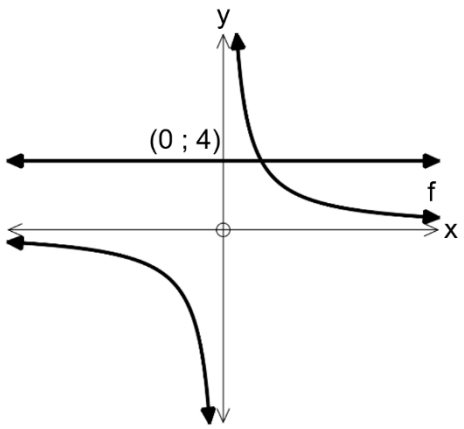
(2) $y = \frac{8}{x} - 10$

(3) $x = \frac{8}{y}$

$\therefore xy = 8$

$\therefore y = \frac{8}{x}$

(f) (1) y-afsnit
horisontale lyn



(2) $f(x) = g(x)$

$\frac{8}{x} = 4$

$\therefore 8 = 4x$

$\therefore x = 2$

$\therefore (2 ; 4)$

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VRAAG 4

(a)
$$120\,000 = \frac{x\left[1-\left(1+\frac{0,0957}{12}\right)^{-60}\right]}{\frac{0,0957}{12}}$$

$$\therefore \frac{120\,000\left(\frac{0,0957}{12}\right)}{\left[1-\left(1+\frac{0,0957}{12}\right)^{-60}\right]} = x$$

$$\therefore x = R2\,524,33$$

(b)
$$1+i_{eff} = \left(1+\frac{i^m}{m}\right)^m$$

$$\therefore 1+i_{eff} = \left(1+\frac{0,0957}{12}\right)^{12}$$

$$\therefore i_{eff} = 0,1$$

$$= 10\%$$

VRAAG 5

(a) $y > -9,5 \quad y \in \mathbb{R}$

(b) $b = -9,5$

$-8 = a^{-1} - 9,5$

$\therefore \frac{3}{2} = a^{-1}$

$a = \frac{2}{3}$

(c)
$$0 = \left(\frac{2}{3}\right)^x - 9,5$$

$$\therefore 9,5 = \left(\frac{2}{3}\right)^x$$

$\therefore x = \log_{\frac{2}{3}} 9,5$

$\therefore x = -5,55$

$\therefore (-5,55 ; 0)$

VRAAG 6

(a) (1) $P(S \cup T) = 0,7 + 0,2$
$= 0,9$

(2) $P(S \cap T) = 0,7 \times 0,2$
$= 0,14$
$P(S \cup T) = P(S) + P(T) - P(S \cap T)$
$= 0,7 + 0,2 - 0,14$
$= 0,76$

(b) (1) $= \frac{7!}{2!}$
$= 2\,520$

(2) $= 5! \div 2\,520$
$= 120 \div 2\,520$
$= \frac{1}{21}$
$\approx 0,05$

OF

$= \frac{2}{7} \times \frac{1}{6}$
$= \frac{1}{21}$
$\approx 0,05$

(3) $= 6! \div 2\,520$
$= \frac{2}{7}$
$\approx 0,29$

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AFDELING B

VRAAG 7

(a) (1) $11 - 2x + \sqrt{2x^2 - 29x + 114} = 0$

$\sqrt{2x^2 - 29x + 114} = 2x - 11$
$\therefore 2x^2 - 29x + 114 = (2x - 11)^2$
$\therefore 2x^2 - 29x + 114 = 4x^2 - 44x + 121$
$\therefore 0 = 2x^2 - 15x + 7$
$\therefore 0 = (x - 7)(2x - 1)$
$\therefore x = 7 \quad \text{of} \quad x \neq \frac{1}{2}$

(2) $0 = 5^{2x} - 9(5^x) - 10$
$\therefore 0 = (5^x - 10)(5^x + 1)$
$\therefore 5^x = 10 \text{ of } 5^x \neq -1$
$\therefore x = \log_5 10$
$\therefore x = 1{,}43$

OF

Laat $k = 5^x$
$\therefore 0 = k^2 - 9k - 10$
$\therefore 0 = (k - 10)(k + 1)$
$\therefore k = 10 \text{ of } k \neq -1$
$\therefore 5^x = 10 \text{ of } 5^x \neq -1$
$\therefore x = \log_5 10$
$\therefore x = 1{,}43$

(3) $x^{\frac{8}{3}} - 9x^{\frac{10}{3}} = 0$
$\therefore x^{\frac{8}{3}}\left(1 - 9x^{\frac{2}{3}}\right) = 0$
$\therefore x^{\frac{8}{3}} = 0 \quad \text{of} \quad 1 = 9x^{\frac{2}{3}}$
$\therefore x = 0 \quad \text{of} \quad \frac{1}{9} = x^{\frac{2}{3}}$
$\therefore \pm\frac{1}{3} = x^{\frac{1}{3}}$
$\therefore \pm\frac{1}{27} = x$

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(b)
$$k = \frac{x}{2}(x-4)$$
$$\therefore 0 = \frac{1}{2}x^2 - 2x - k$$
$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4\left(\frac{1}{2}\right)(-k)}}{2\left(\frac{1}{2}\right)}$$
$$= 2 \pm \sqrt{4 + 2k}$$
$$\therefore 4 + 2k \geq 0$$
$$\therefore 2k \geq -4$$
$$\therefore k \geq -2$$

OF

$$0 = x^2 - 4x - 2k$$
$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-2k)}}{2(1)}$$
$$= \frac{4 \pm \sqrt{16 + 8k}}{2}$$
$$\therefore 16 + 8k \geq 0$$
$$\therefore 8k \geq -16$$
$$\therefore k \geq -2$$

VRAAG 8

(a)
$$x\left(1 + \frac{0{,}11}{4}\right)^{64} + \frac{x}{2}\left(1 + \frac{0{,}11}{4}\right)^{32} = 200\,000$$
$$\therefore x\left[\left(1 + \frac{0{,}11}{4}\right)^{64} + \frac{1}{2}\left(1 + \frac{0{,}11}{4}\right)^{32}\right] = 200\,000$$
$$\therefore x = \frac{200\,000}{\left(1 + \frac{0{,}11}{4}\right)^{64} + \frac{1}{2}\left(1 + \frac{0{,}11}{4}\right)^{32}}$$
$$\therefore x = \text{R}29\,124{,}20$$

(b)
$$F_V = \frac{800\left[\left(1 + \frac{0{,}09}{12}\right)^{121} - 1\right]}{\frac{0{,}09}{12}}\left(1 + \frac{0{,}09}{12}\right)^{72}$$
$$= \text{R}268\,481{,}18$$

VRAAG 9

(a) $h + r = 30$

$\therefore h = 30 - r$

$$V = \frac{1}{3}\pi r^2(30 - r)$$

$$= 10\pi r^2 - \frac{\pi}{3}r^3$$

(b) $$\frac{dV}{dr} = 20\pi r - \pi r^2$$

$\therefore 0 = \pi r(20 - r)$

$\therefore r \neq 0$ of $r = 20$

$$V = 10\pi(20)^2 - \frac{\pi}{3}(20)^3$$

$$= \frac{4\,000\pi}{3}\ cm^3$$

$\approx 4\,188{,}79\ cm^3$

(c) (1) (20 ; 4188,79)

(2) $$0 = 10\pi x^2 - \frac{\pi}{3}x^3$$

$$\therefore 0 = \frac{1}{3}\pi x^2(30 - x)$$

$\therefore x = 0$ of $x = 30$

$f'(x) = 20\pi(30) - \pi(30)^2$

$= -300\pi$

$\approx -942{,}48$

Vervang: $0 = -300\pi(30) + c$

$\therefore c = 9\,000\pi$

$\therefore y = -300\pi x + 9\,000\pi$

$\therefore a = -300$ en $b = 9\,000$

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VRAAG 10

(a) $x = 0$
$x = 5$

(b) $5 < x \leq 6$

(c) $\log_2 x - \log_2(x-5) = 1$

$$\therefore \log_2\left(\frac{x}{x-5}\right) = 1$$

$$\therefore 2 = \frac{x}{x-5}$$

$$\therefore 2x - 10 = x$$

$$\therefore x = 10$$

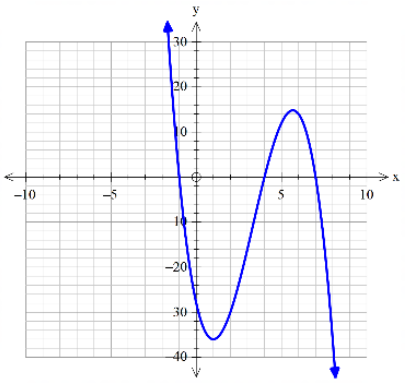
VRAAG 11

(a) $0 = -(y+1)(y-4)(y-7)$
$\therefore y = -1$ of $y = 4$ of $y = 7$
$\therefore$ AC = 8 eenhede

(b) $y = -(x+1)(x-4)(x-7)$

(c) $y = -(x+1)(x-4)(x-7)$
$\therefore y = (-x-1)(x^2 - 11x + 28)$
$\therefore y = -x^3 + 10x^2 - 17x - 28$
$\frac{dy}{dx} = -3x^2 + 20x - 17 = 0$
$\therefore 3x^2 - 20x + 17 = 0$
$\therefore (3x - 17)(x - 1) = 0$

$\therefore x = \frac{17}{3}$ of $x = 1$

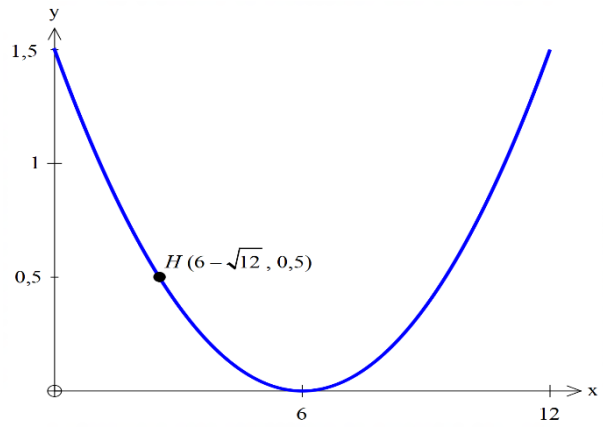


Vervang $y = -(1+1)(1-4)(1-7)$
$\therefore y = -36$

$\therefore$ MN is 36 eenhede

VRAAG 12

(a) Draaipunt by (6 ; 0)
y-afsnit by (0 ; 1,5)
$\therefore y = a(x - 6)^2 + 0$



Vervang (0 ; 1,5): $1,5 = a(0 - 6)^2$

$\therefore \frac{1,5}{36} = a$

$\therefore a = \frac{1}{24}$

$\therefore y = \frac{1}{24}(x - 6)^2$

Vervang y = 0,5: $0,5 = \frac{1}{24}(x - 6)^2$

$\therefore 12 = (x - 6)^2$

$\therefore \pm 2\sqrt{3} = x - 6$

$\therefore x = 6 - 2\sqrt{3}$ of $x = 6 + 2\sqrt{3}$

Die horisontale afstand van H na B is dus $2\sqrt{3}$ meter

OF

Draaipunt by (6 ; –1,5)
y-afsnit by (0 ; 0)

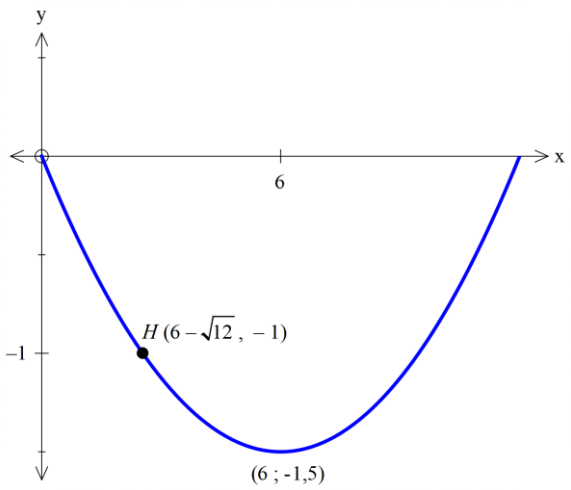
$\therefore y = a(x - 6)^2 - 1,5$

Vervang (0 ; 0): $0 = a(0 - 6)^2 - 1,5$

$\therefore 1,5 = 36a$

$\therefore a = \frac{1}{24}$

$\therefore y = \frac{1}{24}(x - 6)^2 - 1,5$



Vervang y = –1: $-1 = \frac{1}{24}(x - 6)^2 - 1,5$

$\therefore \frac{1}{2} = \frac{1}{24}(x - 6)^2$

$\therefore 12 = (x - 6)^2$

$\therefore \pm 2\sqrt{3} = x - 6$

$\therefore x = 6 - 2\sqrt{3}$ of $x = 6 + 2\sqrt{3}$

Die horisontale afstand van H na B is dus $2\sqrt{3}$ meter

OF

Draaipunt en y-afsnit by (0 ; –1,5)
$\therefore y = ax^2 - 1,5$
Vervang (6 ; 0): $y = a(6^2) - 1,5$
$\therefore 1,5 = 36a$
$\therefore a = \frac{1}{24}$

$\therefore y = \frac{1}{24}x^2 - 1,5$

Vervang y = –1: $-1 = \frac{1}{24}x^2 - 1,5$
$\therefore \frac{1}{2} = \frac{1}{24}x^2$
$\therefore 12 = x^2$
$\therefore x = \pm 2\sqrt{3}$

Die horisontale afstand van H na B is dus $2\sqrt{3}$ meter

(b) $y = \frac{1}{24}(x^2 - 12x + 36)$

$\therefore y = \frac{1}{24}x^2 - \frac{1}{2}x + \frac{3}{2}$

$\frac{dy}{dx} = \frac{1}{12}x - \frac{1}{2}$

Vervang x = 0: $\frac{dy}{dx} = \frac{1}{12}(0) - \frac{1}{2}$ **OF** Vervang x = 12: $\frac{dy}{dx} = \frac{1}{12}(12) - \frac{1}{2}$
$= -\frac{1}{2}$ $= \frac{1}{2}$

OF

$y = \frac{1}{24}(x^2 - 12x + 36) - 1,5$

$\therefore y = \frac{1}{24}x^2 - \frac{1}{2}x$

$\frac{dy}{dx} = \frac{1}{12}x - \frac{1}{2}$

Vervang x = 0: $\frac{dy}{dx} = \frac{1}{12}(0) - \frac{1}{2}$ **OF** Vervang x = 12: $\frac{dy}{dx} = \frac{1}{12}(12) - \frac{1}{2}$
$= -\frac{1}{2}$ $= \frac{1}{2}$

$y = \frac{1}{24}x^2 - 1,5$ vandaar $\frac{dy}{dx} = \frac{x}{12}$ $\therefore m = \frac{6}{12} = \frac{1}{2}$

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VRAAG 13

(a)
$$AC = 1 + 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \ldots$$
$$= 1 + S_\infty$$
$$= 1 + \frac{1}{1-\frac{1}{2}}$$
$$= 1 + 2$$
$$= 3 \text{ meter}$$

(b)
$$BC^2 = 3^2 - 1^2 \qquad \text{(Pythagoras)}$$
$$\therefore BC = 2\sqrt{2} \text{ meter}$$
$$\cos A = \frac{1}{3}$$
$$\therefore A = 70{,}53°$$

$$\text{Opp} = \frac{1}{2}\left(2\sqrt{2}\right)(1) - \frac{70{,}53°}{360°}\left[\pi(1)^2\right] - \left[\frac{1}{2}\pi\left(\frac{1}{2}\right)^2 + \frac{1}{2}\pi\left(\frac{1}{4}\right)^2 + \frac{1}{2}\pi\left(\frac{1}{8}\right)^2 + \ldots\right]$$
$$= \sqrt{2} - \frac{70{,}53°\,\pi}{360°} - \frac{1}{2}\left[\frac{\pi}{4} + \frac{\pi}{16} + \frac{\pi}{64} + \ldots\right]$$
$$= \sqrt{2} - \frac{70{,}53°\,\pi}{360°} - \frac{1}{2}\left[\frac{\frac{\pi}{4}}{1-\frac{1}{4}}\right]$$
$$= \sqrt{2} - \frac{70{,}53°\,\pi}{360°} - \frac{\pi}{6}$$
$$= 0{,}28 \text{ m}^2$$

Totaal: 150 punte

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