



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NASIONALE  
SENIOR SERTIFIKAAT**

**GRAAD 12**

**WISKUNDE V1**

**NOVEMBER 2018**

**PUNTE: 150**

**TYD: 3 uur**

**Hierdie vraestel bestaan uit 9 bladsye en 1 inligtingsblad.**

**INSTRUKSIES EN INLIGTING**

Lees die volgende instruksies aandagtig deur voordat die vrae beantwoord word.

1. Hierdie vraestel bestaan uit 12 vrae.
2. Beantwoord AL die vrae.
3. Nommer die antwoorde korrek volgens die nommeringstelsel wat in hierdie vraestel gebruik is.
4. Dui ALLE berekeninge, diagramme, grafieke, ens. wat jy gebruik het om jou antwoorde te bepaal, duidelik aan.
5. Volpunte sal NIE noodwendig aan slegs antwoorde toegeken word NIE.
6. Jy mag 'n goedgekeurde, wetenskaplike sakrekenaar (nieprogrammeerbaar en niegrafies) gebruik, tensy anders vermeld.
7. Indien nodig, rond antwoorde tot TWEE desimale plekke af, tensy anders vermeld.
8. Diagramme is NIE noodwendig volgens skaal geteken NIE.
9. 'n Inligtingsblad met formules is aan die einde van die vraestel ingesluit.
10. Skryf netjies en leesbaar.

**VRAAG 1**1.1 Los op vir  $x$ :

1.1.1  $x^2 - 4x + 3 = 0$  (3)

1.1.2  $5x^2 - 5x + 1 = 0$  (korrek tot TWEE desimale plekke) (3)

1.1.3  $x^2 - 3x - 10 > 0$  (3)

1.1.4  $3\sqrt{x} = x - 4$  (4)

1.2 Los gelyktydig op vir  $x$  en  $y$ :

$3x - y = 2$  en  $2y + 9x^2 = -1$  (6)

1.3 Indien  $3^{9x} = 64$  en  $5^{\sqrt{p}} = 64$ , bereken, SONDER die gebruik van 'n sakrekenaar, die waarde van:  $\frac{[3^{x-1}]^3}{\sqrt{5}^{\sqrt{p}}}$  (4)**[23]****VRAAG 2**

2.1 Gegee die kwadratiese ry: 2 ; 3 ; 10 ; 23 ; ...

2.1.1 Skryf die volgende term van die ry neer. (1)

2.1.2 Bepaal die  $n^{\text{de}}$  term van die ry. (4)2.1.3 Bereken die  $20^{\text{ste}}$  term van die ry. (2)

2.2 Gegee die rekenkundige ry: 35 ; 28 ; 21 ; ...

Bereken watter term van die ry 'n waarde van  $-140$  sal hê. (3)2.3 Vir watter waarde van  $n$  sal die som van die eerste  $n$  terme van die rekenkundige ry in VRAAG 2.2 gelyk wees aan die  $n^{\text{de}}$  term van die kwadratiese ry in VRAAG 2.1? (6)**[16]**

**VRAAG 3**

'n Meetkundige reeks het 'n konstante verhouding van  $\frac{1}{2}$  en 'n som tot oneindigheid van 6.

3.1 Bereken die eerste term van die reeks. (2)

3.2 Bereken die 8<sup>ste</sup> term van die reeks. (2)

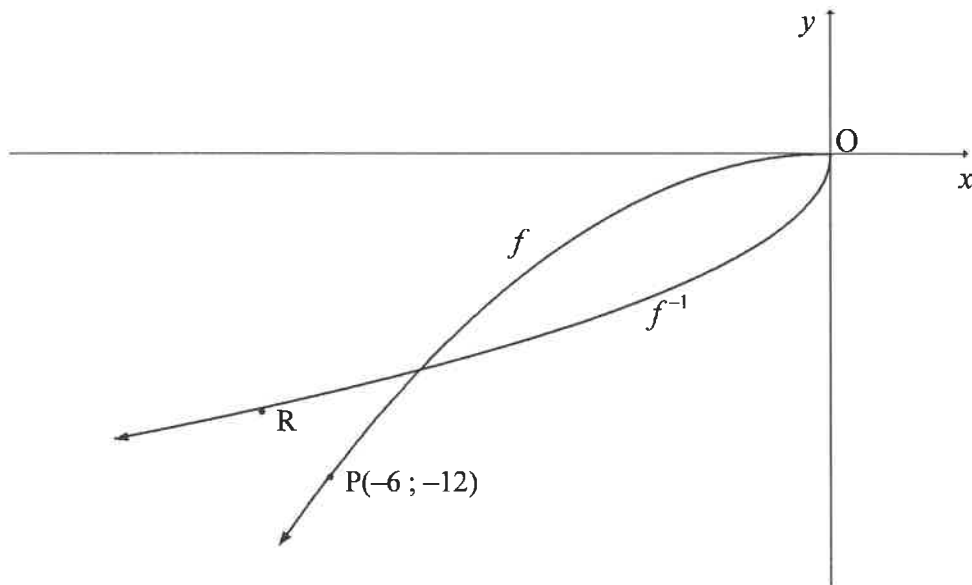
3.3 Gegee:  $\sum_{k=1}^n 3(2)^{1-k} = 5,8125$  Bereken die waarde van  $n$ . (4)

3.4 Indien  $\sum_{k=1}^{20} 3(2)^{1-k} = p$ , skryf  $\sum_{k=1}^{20} 24(2)^{-k}$  in terme van  $p$  neer. (3)  
[11]

**VRAAG 4**

In die diagram hieronder is die grafiek van  $f(x) = ax^2$  in die interval  $x \leq 0$  geteken.

Die grafiek van  $f^{-1}$  is ook geteken. P(-6 ; -12) is 'n punt op  $f$  en R is 'n punt op  $f^{-1}$ .



4.1 Is  $f^{-1}$  'n funksie? Motiveer jou antwoord. (2)

4.2 Indien R die refleksie van P in die lyn  $y = x$  is, skryf die koördinate van R neer. (1)

4.3 Bereken die waarde van  $a$ . (2)

4.4 Skryf die vergelyking van  $f^{-1}$  neer in die vorm  $y = \dots$  (3)

[8]

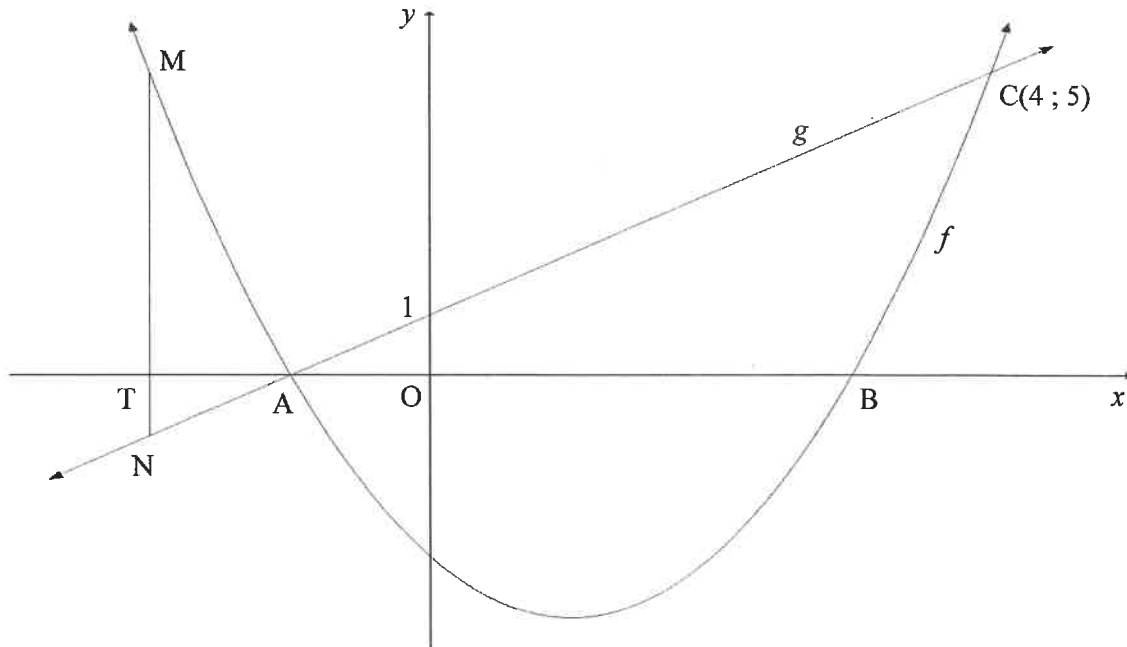
**VRAAG 5**

Gegee:  $f(x) = \frac{-1}{x-1}$

- 5.1 Skryf die definisieversameling van  $f$  neer. (1)
  - 5.2 Skryf die asimptote van  $f$  neer. (2)
  - 5.3 Skets die grafiek van  $f$  en dui alle afsnitte met die asse en enige asimptote duidelik aan. (3)
  - 5.4 Vir watter waardes van  $x$  sal  $x \cdot f'(x) \geq 0$ ? (2)
- [8]**

**VRAAG 6**

In die diagram hieronder is A en B die  $x$ -afsnitte van die grafiek van  $f(x) = x^2 - 2x - 3$ . 'n Reguitlyn,  $g$ , deur A sny  $f$  by C(4 ; 5) en die  $y$ -as by (0 ; 1). M is 'n punt op  $f$  en N is 'n punt op  $g$  sodat MN ewewydig aan die  $y$ -as is. MN sny die  $x$ -as by T.



- 6.1 Toon dat  $g(x) = x + 1$ . (2)
  - 6.2 Bereken die koördinate van A en B. (3)
  - 6.3 Bepaal die waardeversameling van  $f$ . (3)
  - 6.4 As  $MN = 6$ :
    - 6.4.1 Bepaal die lengte van OT as T op die negatiewe  $x$ -as lê. Toon AL jou bewerkinge. (4)
    - 6.4.2 Skryf gevolglik die koördinate van N neer. (2)
  - 6.5 Bepaal die vergelyking van die raaklyn aan  $f$  wat ewewydig aan  $g$  getrek is. (5)
  - 6.6 Vir watter waarde(s) van  $k$  sal  $f(x) = x^2 - 2x - 3$  en  $h(x) = x + k$  NIE sny NIE? (1)
- [20]**

**VRAAG 7**

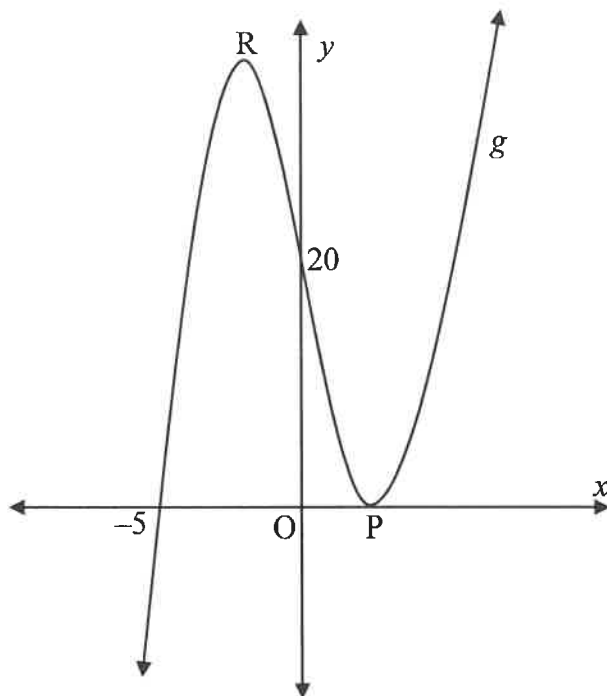
- 7.1 Selby het vandag besluit dat hy oor die volgende vier jaar R15 000 per kwartaal sal spaar. Hy sal binne drie maande die eerste deposito in 'n spaarrekening maak en hy sal aan die einde van vier jaar van nou af die laaste deposito maak.
- 7.1.1 Hoeveel sal Selby aan die einde van vier jaar hê indien rente teen 8,8% per jaar, kwartaalliks saamgestel, verdien word? (3)
- 7.1.2 Indien Selby aan die einde van drie jaar van nou af besluit om R100 000 uit die rekening te onttrek, hoeveel sal hy aan die einde van vier jaar van nou af in die rekening hê? (3)
- 7.2 Tshepo neem 'n huislening oor 20 jaar uit om 'n huis te koop wat R1 500 000 kos.
- 7.2.1 Bereken die maandelikse paaiement indien rente teen 10,5% p.j., maandeliks saamgestel, bereken word. (4)
- 7.2.2 Bereken die uitstaande balans onmiddellik nadat die 144<sup>ste</sup> betaling gemaak is. (5)  
[15]

**VRAAG 8**

- 8.1 Bepaal  $f'(x)$  vanuit eerste beginsels indien dit gegee word dat  $f(x) = x^2 - 5$ . (5)
- 8.2 Bepaal  $\frac{dy}{dx}$  indien:
- 8.2.1  $y = 3x^3 + 6x^2 + x - 4$  (3)
- 8.2.2  $yx - y = 2x^2 - 2x$  ;  $x \neq 1$  (4)  
[12]

## VRAAG 9

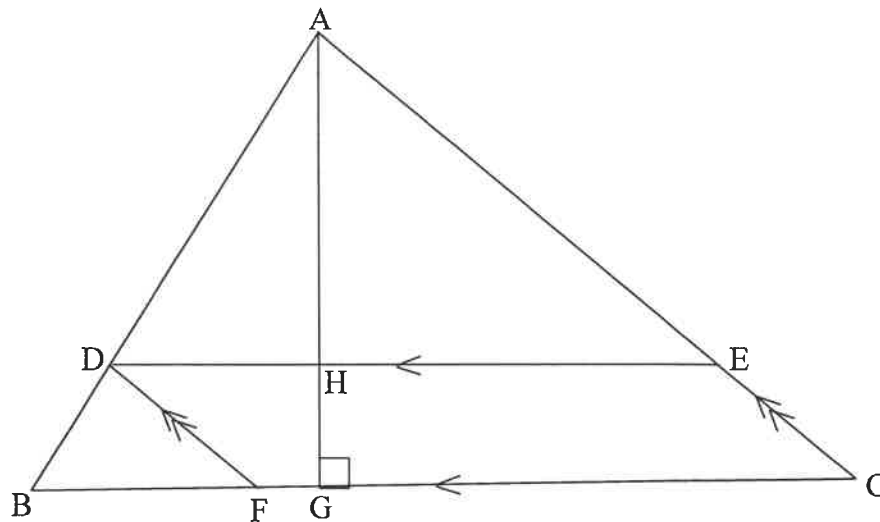
- 9.1 Die grafiek van  $g(x) = x^3 + bx^2 + cx + d$  is hieronder geskets.  
Die grafiek van  $g$  sny die  $x$ -as by  $(-5; 0)$  en by  $P$ , en die  $y$ -as by  $(0; 20)$ .  
 $P$  en  $R$  is draaipunte van  $g$ .



- 9.1.1 Toon dat  $b = 1$ ,  $c = -16$  en  $d = 20$ . (4)
- 9.1.2 Bereken die koördinate van  $P$  en  $R$ . (5)
- 9.1.3 Is die grafiek konkaaf op of konkaaf af by  $(0; 20)$ ? Toon AL jou berekeninge. (3)
- 9.2 Indien  $g$  'n derdemagsfunksie is met:
- $g(3) = g'(3) = 0$
  - $g(0) = 27$
  - $g''(x) > 0$  as  $x < 3$  en  $g''(x) < 0$  as  $x > 3$ ,
- teken 'n sketsgrafiek van  $g$  en dui AL die relevante punte aan. (3)
- [15]

**VRAAG 10**In  $\triangle ABC$ :

- D is 'n punt op AB, E is 'n punt op AC en F is 'n punt op BC sodanig dat DECF 'n parallelogram is.
- $BF : FC = 2 : 3$ .
- Die loodregte hoogte AG word getrek om DE by H te sny.
- $AG = t$  eenhede.
- $BC = (5 - t)$  eenhede.



10.1 Skryf neer  $AH : HG$ . (1)

10.2 Bereken  $t$  indien die oppervlakte van die parallelogram 'n maksimum is.  
(LET WEL: Oppervlakte van 'n parallelogram = basis  $\times$   $\perp$  hoogte) (5)  
[6]

**VRAAG 11**

Gegee die syfers: 3 ; 4 ; 5 ; 6 ; 7 ; 8 en 9

11.1 Bereken hoeveel unieke 5-syfer-kodes gevorm kan word deur die syfers hierbo te gebruik, indien:

11.1.1 Die syfers herhaal kan word (2)

11.1.2 Die syfers nie herhaal kan word nie (2)

11.2 Hoeveel unieke 3-syfer-kodes kan gevorm word deur die syfers hierbo te gebruik, indien:

- Syfers herhaal kan word
- Die kode groter as 400 maar kleiner as 600 is
- Die kode deur 5 deelbaar is

(3)  
[7]



**VRAAG 12**

12.1 Gegee:  $P(A) = 0,45$ ;  $P(B) = y$  en  $P(A \text{ of } B) = 0,74$

Bepaal die waarde(s) van  $y$  indien  $A$  en  $B$  onderling uitsluitend is. (3)

12.2 'n Organisasie besluit om geskenksakkies met lekkers vir 'n graad R-klas by 'n sekere skool, te gee. Daar is 'n geheime geskenk in presies  $\frac{1}{4}$  van die totale getal sakkies.

Elke leerder in die klas kan twee geskenksakkies met lekkers willekeurig kies, die een na die ander. Die waarskynlikheid dat 'n leerder twee sakkies lekkers met 'n geheime geskenk sal kies, is  $\frac{7}{118}$ . Bereken die getal geskenksakkies met lekkers wat 'n geheime geskenk in het. (6)

[9]

**TOTAAL: 150**

## INLIGTINGSBLAD

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

$$A = P(1 - i)^n$$

$$A = P(1 + i)^n$$

$$T_n = a + (n-1)d$$

$$S_n = \frac{n}{2} [2a + (n-1)d]$$

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1}; r \neq 1$$

$$S_\infty = \frac{a}{1 - r}; -1 < r < 1$$

$$F = \frac{x[(1+i)^n - 1]}{i}$$

$$P = \frac{x[1 - (1+i)^{-n}]}{i}$$

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

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

$$(x - a)^2 + (y - b)^2 = r^2$$

$$\text{In } \Delta ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$\text{area } \Delta ABC = \frac{1}{2} ab \cdot \sin C$$

$$\sin(\alpha + \beta) = \sin \alpha \cdot \cos \beta + \cos \alpha \cdot \sin \beta$$

$$\sin(\alpha - \beta) = \sin \alpha \cdot \cos \beta - \cos \alpha \cdot \sin \beta$$

$$\cos(\alpha + \beta) = \cos \alpha \cdot \cos \beta - \sin \alpha \cdot \sin \beta$$

$$\cos(\alpha - \beta) = \cos \alpha \cdot \cos \beta + \sin \alpha \cdot \sin \beta$$

$$\cos 2\alpha = \begin{cases} \cos^2 \alpha - \sin^2 \alpha \\ 1 - 2\sin^2 \alpha \\ 2\cos^2 \alpha - 1 \end{cases}$$

$$\sin 2\alpha = 2\sin \alpha \cdot \cos \alpha$$

$$\bar{x} = \frac{\sum x}{n}$$

$$\sigma^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}$$

$$P(A) = \frac{n(A)}{n(S)}$$

$$P(A \text{ of } B) = P(A) + P(B) - P(A \text{ en } B)$$

$$\hat{y} = a + bx$$

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$



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**GRADE 12/GRAAD 12**

**MATHEMATICS P1/WISKUNDE VI**

**NOVEMBER 2018**

**MARKING GUIDELINES/NASIENRIGLYNE**

**MARKS: 150**

**PUNTE: 150**

**These marking guidelines consist of 18 pages.  
*Hierdie nasienriglyne bestaan uit 18 bladsye***

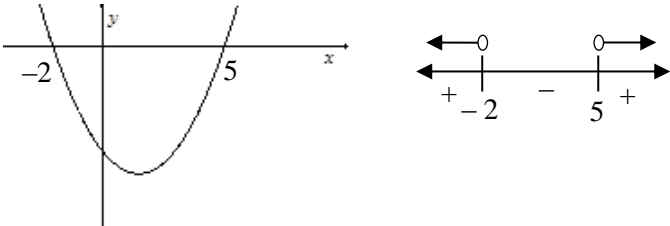
**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent Accuracy applies in all aspects of the marking memorandum.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.

**QUESTION/VRAAG 1**

<p>1.1.1</p>	$x^2 - 4x + 3 = 0$ $(x - 3)(x - 1) = 0$ $x = 3 \text{ or } x = 1$	<p>✓ factors/correct sub in formula                  ✓ <math>x = 3</math>                  ✓ <math>x = 1</math></p> <p style="text-align: right;">(3)</p>
<p>1.1.2</p>	$5x^2 - 5x + 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{5 \pm \sqrt{25 - 4(5)(1)}}{2(5)}$ $= \frac{5 \pm \sqrt{5}}{10}$ $x = 0,72 \text{ or } x = 0,28$	<p>✓ substitution into the correct formula</p> <p>✓ <math>x = 0,72</math>                  ✓ <math>x = 0,28</math></p> <p style="text-align: right;">(3)</p>
<p>1.1.3</p>	$x^2 - 3x - 10 > 0$ $(x - 5)(x + 2) > 0$ <p><b>OR/OF</b></p>  $x < -2 \text{ or } x > 5$	<p>✓ factors/ critical values</p> <p>✓✓ <math>x &lt; -2 \text{ or } x &gt; 5</math></p> <p style="text-align: right;">(3)</p>
<p>1.1.4</p>	$3\sqrt{x} = x - 4$ $9x = x^2 - 8x + 16$ $x^2 - 17x + 16 = 0$ $(x - 16)(x - 1) = 0$ $x = 16 \text{ or } x = 1$ <p style="text-align: center;">NA</p>	<p>✓ squaring both sides                  ✓ <math>x^2 - 17x + 16 = 0</math>                  ✓ factors                  ✓ answer with selection</p> <p style="text-align: right;">(4)</p>

	<p><b>OR/OF</b></p> $\frac{1}{3x^2} = x - 4$ $x - 3x^{\frac{1}{2}} - 4 = 0$ $\left(x^{\frac{1}{2}} - 4\right)\left(x^{\frac{1}{2}} + 1\right) = 0$ $\frac{1}{x^2} = 4 \quad \text{or} \quad \frac{1}{x^2} = -1$ $x = 16 \quad \quad \quad \text{NA}$	<p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ standard form</li> <li>✓ recognize <math>x = \left(x^{\frac{1}{2}}\right)^2</math></li> <li>✓ factors</li> <li>✓ answer with selection</li> </ul> <p style="text-align: right;">(4)</p>
<p>1.2</p>	<p> <math>2y + 9x^2 = -1 \dots\dots(1)</math>  <math>3x - y = 2 \dots\dots (2)</math>  <math>y = 3x - 2 \dots\dots(3)</math>  <math>2(3x - 2) + 9x^2 = -1</math>  <math>6x - 4 + 9x^2 = -1</math>  <math>9x^2 + 6x - 3 = 0</math>  <math>3x^2 + 2x - 1 = 0</math>  <math>(3x - 1)(x + 1) = 0</math>  <math>x = \frac{1}{3} \quad \text{or} \quad x = -1</math>  <math>y = -1 \quad \text{or} \quad y = -5</math> </p> <p><b>OR/OF</b></p> <p> <math>2y + 9x^2 = -1 \dots\dots(1)</math>  <math>3x - y = 2 \dots\dots (2)</math>  <math>x = \frac{y + 2}{3}</math>  <math>2y + 9\left(\frac{y + 2}{3}\right)^2 = -1</math>  <math>2y + 9\left(\frac{y^2 + 4y + 4}{9}\right) = -1</math>  <math>2y + y^2 + 4y + 4 + 1 = 0</math>  <math>y^2 + 6y + 5 = 0</math>  <math>(y + 5)(y + 1) = 0</math>  <math>y = -1 \quad \text{or} \quad y = -5</math>  <math>x = \frac{1}{3} \quad \text{or} \quad x = -1</math> </p>	<ul style="list-style-type: none"> <li>✓ <math>y = 3x - 2</math></li> <li>✓ substitution</li> </ul> <ul style="list-style-type: none"> <li>✓ standard form</li> <li>✓ factors</li> <li>✓ both <math>x</math> values</li> <li>✓ both <math>y</math> values</li> </ul> <p style="text-align: right;">(6)</p> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ <math>x = \frac{y + 2}{3}</math></li> <li>✓ substitution</li> </ul> <ul style="list-style-type: none"> <li>✓ standard form</li> <li>✓ factors</li> <li>✓ both <math>y</math> values</li> <li>✓ both <math>x</math> values</li> </ul> <p style="text-align: right;">(6)</p>

<p>1.3</p>	$3^{9x} = 64$ $(3^{3x})^3 = (4)^3$ $3^{3x} = 4$ $5^{\sqrt{p}} = 64$ $\sqrt{5}^{\sqrt{p}} = \sqrt{64}$ $\sqrt{5}^{\sqrt{p}} = 8$ $\frac{[3^{x-1}]^3}{\sqrt{5}^{\sqrt{p}}} = \frac{3^{3x-3}}{\sqrt{5}^{\sqrt{p}}}$ $= \frac{3^{3x}}{27 \times \sqrt{5}^{\sqrt{p}}}$ $= \frac{4}{27 \times 8}$ $= \frac{1}{54}$ <p><b>OR/OF</b></p> $\frac{(3^{x-1})^3}{\sqrt{5}^{\sqrt{p}}} = \frac{3^{3x} \cdot 3^{-3}}{(5^{0.5})^{\sqrt{p}}}$ $= \frac{3^{3x} \cdot 3^{-3}}{(5^{\sqrt{p}})^{0.5}}$ $= \frac{4 \cdot 3^{-3}}{\sqrt{64}}$ $= \frac{4 \cdot \frac{1}{27}}{8} = \frac{1}{54}$ <p><b>OR/OF</b></p> $= \frac{3^{3x} \cdot 3^{-3}}{5^{\frac{\sqrt{p}}{2}}}$ $= \frac{\sqrt[3]{64 \cdot 3^{-3}}}{\sqrt{64}}$	<p>✓ <math>3^{3x} = 4</math></p> <p>✓ <math>\sqrt{5}^{\sqrt{p}} = 8</math></p> <p>✓ <math>3^{3x-3}</math> or <math>3^{3x} \cdot 3^{-3}</math></p> <p>✓ answer (4)</p> <p><b>OR/OF</b></p> <p>✓ <math>3^{3x-3}</math> or <math>3^{3x} \cdot 3^{-3}</math></p> <p>✓ <math>3^{3x} = 4</math></p> <p>✓ <math>\sqrt{5}^{\sqrt{p}} = 8</math></p> <p>✓ answer (4)</p> <p>[23]</p>
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**QUESTION/VRAAG 2**

2.1.1	42	✓ answer (1)
2.1.2	$2a = 6$ $a = 3$ $T_n = 3n^2 - 8n + 7$ <p><b>OR/OF</b></p> $2a = 6$ $a = 3$ $T_n = 3n^2 + bn + c$ $T_1 : 3 + b + c = 2$ $T_2 : 12 + 2b + c = 3$ $T_2 - T_1 : b = -8$ <p>Subst. in (1): <math>-8 + c = -1</math></p> $c = 7$ $T_n = 3n^2 - 8n + 7$	$3a + b = 1$ $3(3) + b = 1$ $b = -8$ $a + b + c = 2$ $(3) + (-8) + c = 2$ $c = 7$ <p><b>OR/OF</b></p> $b + c = -1 \dots\dots(1)$ $2b + c = -9 \dots\dots(2)$ $b = -8$ $-8 + c = -1$ $c = 7$
2.1.3	$T_{20} = 3(20)^2 - 8(20) + 7$ $= 1047$	✓ substitution ✓ answer (2)
2.2	$T_n = -7n + 42$ $-7n + 42 = -140$ $-7n = -182$ $n = 26$	✓ $T_n = -7n + 42$ ✓ $-7n + 42 = -140$ ✓ $n = 26$ (3)
2.3	$S_n = \frac{n}{2}(a + l)$ $S_n = \frac{n}{2}(35 - 7n + 42)$ $S_n = \frac{n}{2}(-7n + 77)$ $S_n = -\frac{7}{2}n^2 + \frac{77}{2}n$ $-\frac{7}{2}n^2 + \frac{77}{2}n = 3n^2 - 8n + 7$ $13n^2 - 93n + 14 = 0$ $(n - 7)(13n - 2) = 0$ $n = 7 \text{ or } n = \frac{2}{13}$ <p>NA</p> $\therefore n = 7$	<p><b>OR/OF</b> <math>S_n = \frac{n}{2}[2a + (n - 1)d]</math></p> $S_n = \frac{n}{2}(70 - 7n + 7)$ $S_n = \frac{n}{2}(35 - 7n + 42) \text{ or } S_n = \frac{n}{2}(70 - 7n + 7)$ <p>✓ simplification of <math>S_n</math>                  ✓ equating                  ✓ standard form                  ✓ factors                  ✓ answer with selection                  (6)</p>
		<b>[16]</b>

**QUESTION/VRAAG 3**

<p>3.1</p>	$r = \frac{1}{2} \text{ and } S_{\infty} = 6$ $S_{\infty} = \frac{a}{1-r}$ $6 = \frac{a}{1-\frac{1}{2}}$ $a = 3$	<p>✓ substitution</p> <p>✓ answer</p> <p style="text-align: right;">(2)</p>
<p>3.2</p>	$T_n = ar^{n-1}$ $T_8 = 3\left(\frac{1}{2}\right)^7$ $T_8 = \frac{3}{128}$	<p>✓✓ <math>T_8 = 3\left(\frac{1}{2}\right)^7</math></p> <p style="text-align: right;">(2)</p>
<p>3.3</p>	$\sum_{k=1}^n 3(2)^{1-k} = 5,8125$ $3 + \frac{3}{2} + \frac{3}{4} + \dots = 5,8125$ $S_n = \frac{a(1-r^n)}{1-r} = 5,8125$ $\frac{3\left[1-\left(\frac{1}{2}\right)^n\right]}{1-\frac{1}{2}} = 5,8125$ $6\left[1-\left(\frac{1}{2}\right)^n\right] = 5,8125$ $\left(\frac{1}{2}\right)^n = \frac{1}{32} = 0,03125$ $2^{-n} = 2^{-5} \quad \text{or} \quad n \log \frac{1}{2} = \log \frac{1}{32}$ $n = 5 \quad \quad \quad n = 5$	<p>✓ <math>r = \frac{1}{2}</math></p> <p>✓ substitution</p> <p>✓ simplification</p> <p>✓ answer</p> <p style="text-align: right;">(4)</p>

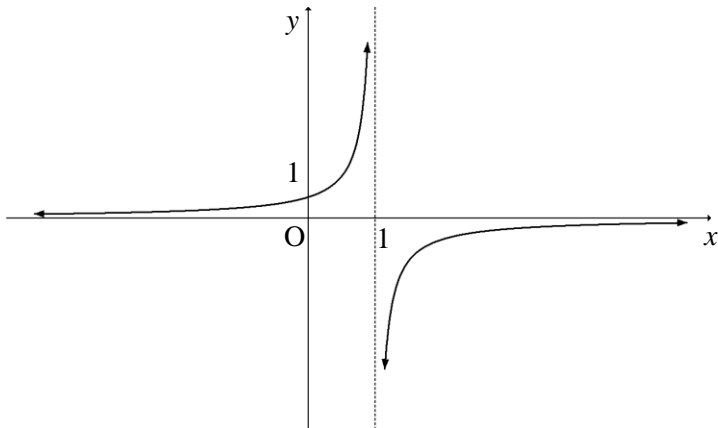


<p>3.4</p>	$\sum_{k=1}^{20} 3(2)^{1-k} = p$ $3 + \frac{3}{2} + \frac{3}{4} + \dots + 3 \cdot 2^{-19} = p$ $\sum_{k=1}^{20} 24(2)^{-k}$ $= 12 + 6 + 3 + \dots + 24 \cdot 2^{-20}$ $= 4 \left( 3 + \frac{3}{2} + \frac{3}{4} + \dots + 3 \cdot 2^{-19} \right)$ $= 4p$ <p><b>OR/OF</b></p> $\sum_{k=1}^{20} 3(2)^{1-k} = p$ $\sum_{k=1}^{20} 6(2)^{-k} = p$ $\therefore \sum_{k=1}^{20} 24(2)^{-k} = 4p$ <p><b>OR/OF</b></p> $\sum_{k=1}^{20} 24(2)^{-k} = \sum_{k=1}^{20} 4 \times 3 \times 2(2)^{-k}$ $= 4 \sum_{k=1}^{20} 3 \times 2(2)^{-k}$ $= 4 \sum_{k=1}^{20} 3 \times (2)^{1-k} = 4p$ <p><b>OR/OF</b></p> $S_{20} = \frac{3 \left( \left( \frac{1}{2} \right)^{20} - 1 \right)}{\frac{1}{2} - 1} = 6 = p$ $S_{20} = \frac{12 \left( \left( \frac{1}{2} \right)^{20} - 1 \right)}{\frac{1}{2} - 1} = 24$ $24 = 4 \times 6 = 4p$	<p>✓ expansion</p> <p>✓ expansion</p> <p>✓ answer (3)</p> <p><b>OR/OF</b></p> <p>✓ <math>\sum_{k=1}^{20} 6(2)^{-k} = p</math></p> <p>✓ <math>\sum_{k=1}^{20} 4 \times 6(2)^{-k}</math></p> <p>✓ <math>4p</math> (3)</p> <p><b>OR/OF</b></p> <p>✓ <math>\sum_{k=1}^{20} 4 \times 3 \times 2(2)^{-k}</math></p> <p>✓ <math>4 \sum_{k=1}^{20} 3 \times 2(2)^{-k}</math></p> <p>✓ <math>4p</math> (3)</p> <p><b>OR/OF</b></p> <p>✓ substitution and answer</p> <p>✓ substitution and answer</p> <p>✓ <math>4p</math> (3)</p> <p style="text-align: right;"><b>[11]</b></p>
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**QUESTION/VRAAG 4**

4.1	Yes For every $x$ -value there is only one corresponding $y$ value <b>OR/OF</b> One to one mapping (vertical line test)	✓ answer ✓ reason  (2)
4.2	$R(-12 ; -6)$	✓ answer (1)
4.3	$f(x) = ax^2$ substitute $(-6 ; -12)$ $-12 = a(-6)^2$ $a = \frac{-1}{3}$	✓ substitution ✓ answer (2)
4.4	$f : y = -\left(\frac{1}{3}\right)x^2$ $f^{-1} : x = -\left(\frac{1}{3}\right)y^2$ $y^2 = -3x$ $y = \pm\sqrt{-3x}$ Only $y = -\sqrt{-3x}$ and $x \leq 0$	✓ swapping $x$ and $y$ ✓ $y^2 = -3x$ ✓ $y = -\sqrt{-3x}$ (3)
		<b>[8]</b>

**QUESTION/VRAAG 5**

5.1	Domain: $x \in R ; x \neq 1$ <b>OR/OF</b> $x \in (-\infty;1) \cup (1;\infty)$	✓ answer (1)
5.2	$x = 1$ $y = 0$	✓ $x = 1$ ✓ $y = 0$ (2)
5.3		✓ $y$ intercept ✓ vertical asymptote ✓ shape (3)
5.4	$x \geq 0 ; x \neq 1$ <b>OR/OF</b> $0 \leq x < 1$ or $x > 1$ <b>OR/OF</b> $x \in [0;1) \cup (1;\infty)$	✓ $x \geq 0$ ✓ $x \neq 1$ <b>OR/OF</b> ✓ $0 \leq x < 1$ ✓ $x > 1$ (2)
		<b>[8]</b>

**QUESTION/VRAAG 6**

6.1	$y = mx + c$ $m = \frac{5-1}{4-0}$ $m = 1$ $c = 1$ $g(x) = x + 1$ <b>OR/OF</b> $y = mx + c$ $5 = m(4) + 1$ $m = 1$ $g(x) = x + 1$	✓ substitution into gradient formula ✓ y-intercept (0 ; 1) (2)  <b>OR/OF</b>  ✓ substitute (4 ; 5) ✓ c = 1 (2)
6.2	$x^2 - 2x - 3 = 0$ $(x+1)(x-3) = 0$ $x = -1 \text{ or } x = 3$ $A(-1 ; 0) \quad B(3 ; 0)$	✓ y = 0 ✓ factors ✓ x-values (3)
6.3	$x = \frac{-1+3}{2} \quad \text{or} \quad x = \frac{-b}{2a} = \frac{-(-2)}{2(1)} \quad \text{or} \quad f'(x) = 2x - 2 = 0$ $x = 1$ $f(x) = x^2 - 2x - 3$ $y = (1)^2 - 2(1) - 3 \quad \text{or} \quad y = (x^2 - 2x + (-1)^2) - 3 - 1$ $y = -4 \quad \quad \quad = (x-1)^2 - 4$ $y \geq -4 \quad \text{or} \quad [-4; \infty)$	✓ x -value  ✓ substitution/ completing the square  ✓ answer (3)
6.4.1	<b>MN:</b> $y = (x^2 - 2x - 3) - (x + 1)$ $= x^2 - 3x - 4$ $6 = x^2 - 3x - 4$ $0 = x^2 - 3x - 10$ $0 = (x-5)(x+2)$ $x = 5 \text{ or } x = -2$ $OT = 2 \text{ or } OT = 5$ $NA$	✓ $x^2 - 3x - 4$ ✓ substituting y = 6  ✓ values of x  ✓ OT = 2 (4)
6.4.2	$y = x + 1 \text{ substitute } x = -2$ $= (-2) + 1$ $= -1$ $N(-2 ; -1)$	✓ substituting x = -2  ✓ answer (2)

6.5	$f'(x) = 2x - 2$ $2x - 2 = 1$ $x = \frac{3}{2}$ $f\left(\frac{3}{2}\right) = \frac{-15}{4}$ $y + \frac{15}{4} = 1\left(x - \frac{3}{2}\right) \quad \text{or} \quad -\frac{15}{4} = \frac{1}{2} + c$ $y = x - \frac{21}{4}$ <p><b>OR/OF</b></p> $x^2 - 2x - 3 = x + p$ $x^2 - 2x - 3 - x - p = 0$ <p>This equation will have equal roots, therefore:</p> $b^2 - 4ac = 0$ $(-3)^2 - 4(1)(-3 - p) = 0$ $9 + 12 + 4p = 0$ $p = \frac{-21}{4}$ $y = x - \frac{21}{4}$	$\checkmark f'(x) = 2x - 2$ $\checkmark 2x - 2 = 1$ $\checkmark x = \frac{3}{2}$ $\checkmark f\left(\frac{3}{2}\right) = \frac{-15}{4}$ $\checkmark \text{answer} \quad (5)$ <p><b>OR/OF</b></p> $\checkmark \text{equating}$ $\checkmark \text{equal roots}$ $\checkmark \text{substitution}$ $\checkmark \text{simplification}$ $\checkmark \text{answer} \quad (5)$
6.6	$k < \frac{-21}{4}$	$\checkmark \text{answer} \quad (1)$
		<b>[20]</b>

**QUESTION/VRAAG 7**

<p>7.1.1</p>	$F = \frac{x[(1+i)^n - 1]}{i}$ $F = \frac{15\,000 \left[ \left( 1 + \frac{0,088}{4} \right)^{16} - 1 \right]}{\frac{0,088}{4}}$ $F = R283\,972,28$	<p>✓ <math>\frac{0,088}{4}</math> and <math>n = 16</math>                  ✓ substitution into correct formula                  ✓ answer</p> <p>(3)</p>
<p>7.1.2</p>	$A = R283\,972,28 - 100\,000 \left( 1 + \frac{0,088}{4} \right)^4$ $= R\,174\,877,60$ <p><b>OR/OF</b>                  Amount at end of 3 years:</p> $F = \frac{15\,000 \left[ \left( 1 + \frac{0,088}{4} \right)^{12} - 1 \right]}{\frac{0,088}{4}} - 100\,000$ $= R103\,459,12$ <p>Amount at end of 4 years:</p> $P(1+i)^n + \frac{x[(1+i)^n - 1]}{i}$ $= 103\,459,12 \left( 1 + \frac{0,088}{4} \right)^4 + \frac{15\,000 \left[ \left( 1 + \frac{0,088}{4} \right)^4 - 1 \right]}{\frac{0,088}{4}}$ $= R\,174\,877,60$	<p>✓ future value – amount including interest                  ✓ <math>100\,000 \left( 1 + \frac{0,088}{4} \right)^4</math>                  ✓ answer</p> <p><b>OR/OF</b></p> <p>✓ R15 000 including interest – R100 000</p> <p>✓ <math>\left( 1 + \frac{0,088}{4} \right)^4</math> on <math>P</math> and <math>x</math> in <math>F_v</math>                  ✓ method</p> <p>(3)</p>
<p>7.2.1</p>	$P = \frac{x[1 - (1+i)^{-n}]}{i}$ $1\,500\,000 = \frac{x \left[ 1 - \left( 1 + \frac{0,105}{12} \right)^{-12 \times 20} \right]}{\frac{0,105}{12}}$ $x = R14\,975,70$	<p>✓ <math>i = \frac{0,105}{12}</math>                  ✓ <math>n = 240</math>                  ✓ substitution into correct formula                  ✓ answer</p> <p>(4)</p>

<p>7.2.2</p>	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $P = \frac{14\,975,70 \left[ 1 - \left( 1 + \frac{0,105}{12} \right)^{-12 \times 8} \right]}{\frac{0,105}{12}}$ <p><math>P = R969\,927,74</math></p> <p><b>OR/OF</b></p> <p>Balance outstanding = A – F</p> $= 1\,500\,000 \left( 1 + \frac{0,105}{12} \right)^{144} - \frac{14\,975,70 \left[ \left( 1 + \frac{0,105}{12} \right)^{144} - 1 \right]}{\frac{0,105}{12}}$ $= R5\,259\,229,61 - R4\,289\,302,47$ $= R969\,927,14$	<p>✓ R14 975,70 in P<sub>v</sub>-formula                  ✓✓ <math>n = 96</math></p> <p>✓ substitution into correct formula</p> <p>✓ answer (5)</p> <p><b>OR/OF</b></p> <p>✓ <math>n = 144</math> in A-formula                  ✓ <math>n = 144</math> in F<sub>v</sub>-formula                  ✓ R14 975,70                  ✓ A – F</p> <p>✓ answer (5)</p>
		<p><b>[15]</b></p>

**QUESTION/VRAAG 8**

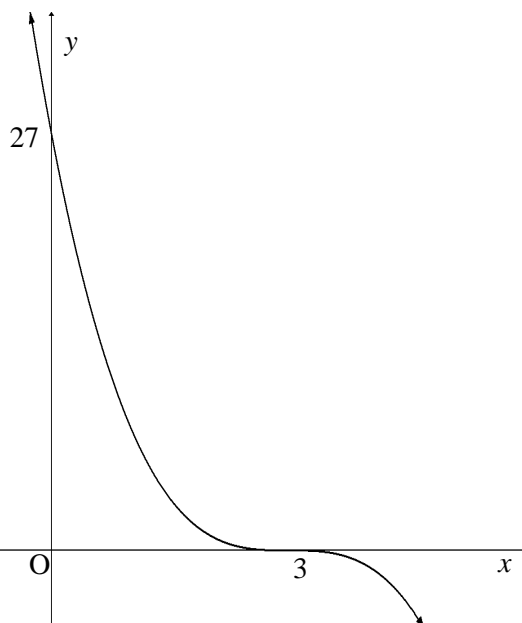
<p>8.1</p>	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 - 5 - x^2 + 5}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x + h)}{h}$ $= \lim_{h \rightarrow 0} (2x + h)$ $= 2x$ <p><b>OR/OF</b></p> $f(x+h) = (x+h)^2 - 5$ $= x^2 + 2xh + h^2 - 5$ $f(x+h) - f(x) = x^2 + 2xh + h^2 - 5 - (x^2 - 5)$ $= 2xh + h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x + h)}{h}$ $= \lim_{h \rightarrow 0} (2x + h)$ $= 2x$	<p>✓ <math>x^2 + 2xh + h^2 - 5</math>                  ✓ simplification                  ✓ factorisation                  ✓ <math>\lim_{h \rightarrow 0} (2x + h)</math>                  ✓ <math>2x</math></p> <p>(5)</p> <p><b>OR/OF</b></p> <p>✓ <math>x^2 + 2xh + h^2 - 5</math>                  ✓ simplification                  ✓ factorisation                  ✓ <math>\lim_{h \rightarrow 0} (2x + h)</math>                  ✓ <math>2x</math></p> <p>(5)</p>
<p>8.2.1</p>	$y = 3x^3 + 6x^2 + x - 4$ $\frac{dy}{dx} = 9x^2 + 12x + 1$	<p>✓ <math>9x^2</math>                  ✓ <math>12x</math>                  ✓ <math>1</math></p> <p>(3)</p>
<p>8.2.2</p>	$y(x-1) = 2x(x-1)$ $y = \frac{2x(x-1)}{x-1} \text{ if } x \neq 1$ $y = 2x$ $\frac{dy}{dx} = 2$	<p>✓ <math>y(x-1)</math>                  ✓ <math>2x(x-1)</math>                  ✓ <math>y = 2x</math>                  ✓ answer</p> <p>(4)</p>
<p><b>[12]</b></p>		

**QUESTION/VRAAG 9**

9.1.1	$g(x) = (x+5)(x-x_1)^2$ $20 = 5(x_1)^2$ $x_1^2 = 4$ $x_1 = 2$ $g(x) = (x+5)(x-2)^2$ $g(x) = (x+5)(x^2 - 4x + 4)$ $g(x) = x^3 + x^2 - 16x + 20$	$\checkmark (x+5)$  $\checkmark$ repeated root $\checkmark x_1 = 2$  $\checkmark g(x) = (x+5)(x^2 - 4x + 4)$ (4)
9.1.2	$g(x) = x^3 + x^2 - 16x + 20$ $g'(x) = 3x^2 + 2x - 16$ $3x^2 + 2x - 16 = 0$ $(3x+8)(x-2) = 0$ $x = \frac{-8}{3} \text{ or } x = 2$ $R\left(\frac{-8}{3}; \frac{1372}{27}\right) \text{ or } R(-2,67; 50,81)$ $P(2;0)$	$\checkmark$ derivative  $\checkmark$ equating to zero $\checkmark$ factors  $\checkmark$ co-ordinates of R $\checkmark$ co-ordinates of P (5)
9.1.3	$g''(x) = 6x + 2$ $g''(0) = 2$ $\therefore \text{concave up}$  <b>OR/OF</b>  $g''(x) = 6x + 2$ $6x + 2 = 0$ $x = -\frac{1}{3} \text{ is the point of inflection}$  $\therefore \text{concave up}$	$\checkmark g''(x) = 6x + 2$ $\checkmark g''(0) = 2$ $\checkmark$ conclusion (3)  <b>OR/OF</b>  $\checkmark g''(x) = 6x + 2$ $\checkmark x = -\frac{1}{3}$  $\checkmark$ conclusion (3)



9.2



✓  $y$  – intercept of a cubic graph

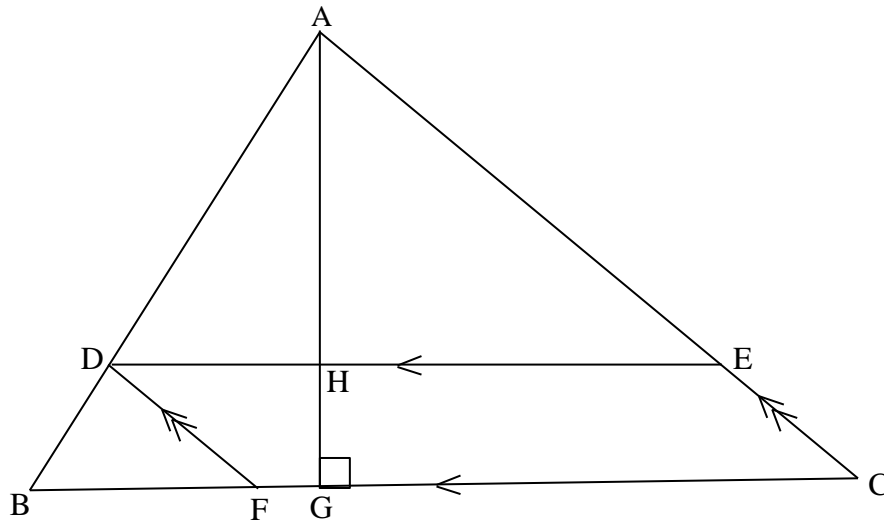
✓ point of inflection and stationary point,  $x = 3$

✓ concave up for  $x < 3$  and concave down for  $x > 3$

(3)

**[15]**

**QUESTION/VRAAG 10**

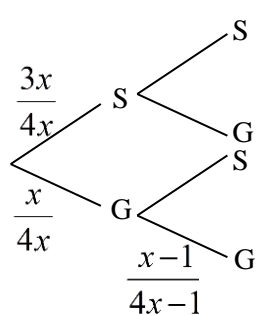


10.1	$\frac{AH}{HG} = \frac{3}{2}$	✓ answer (1)
10.2	Area of a parallelogram = base $\times$ $\perp$ height $\text{Area} = \frac{3}{5}(5-t) \cdot \frac{2}{5}t$ $\text{Area} = \frac{6}{25}(5-t)t$ $A(t) = -\frac{6}{25}t^2 + \frac{6}{5}t$ $A'(t) = -\frac{12}{25}t + \frac{6}{5}$ $-\frac{12}{25}t + \frac{6}{5} = 0$ $12t - 30 = 0$ $t = \frac{30}{12} \text{ or } \frac{5}{2}$	$\checkmark \frac{2}{5}t$ $\checkmark \frac{3}{5}(5-t)$ $\checkmark A(t) = -\frac{6}{25}t^2 + \frac{6}{5}t$ $\checkmark -\frac{12}{25}t + \frac{6}{5}$ ✓ answer (5)
		<b>[6]</b>

**QUESTION/VRAAG 11**

11.1.1	$7^5 = 16\ 807$	✓✓ answer (2)
11.1.2	$7 \times 6 \times 5 \times 4 \times 3$ $= \frac{7!}{2!} = 2520$	✓ $7 \times 6 \times 5 \times 4 \times 3$ or $\frac{7!}{2!}$ ✓ answer (2)
11.2	$2 \times 7 \times 1 = 14$	✓✓✓ $2 \times 7 \times 1$ (3)
		[7]

**QUESTION/VRAAG 12**

12.1	$P(A \text{ or } B) = P(A) + P(B)$ $0,74 = 0,45 + y$ $y = 0,29$	✓ $P(A \text{ or } B) = P(A) + P(B)$ ✓ substitution ✓ answer (3)
12.2	 <p>Let the number of mystery gift bags = <math>x</math> The total number of bags = <math>4x</math></p> $\left(\frac{x}{4x}\right) \times \left(\frac{x-1}{4x-1}\right) = \frac{7}{118}$ $\frac{1}{4} \times \frac{x-1}{4x-1} = \frac{7}{118}$ $\frac{x-1}{4x-1} = \frac{28}{118}$ $118x - 118 = 112x - 28$ $x = 15$	<p>✓ <math>4x</math></p> <p>✓ <math>\left(\frac{x}{4x}\right)</math> or <math>\left(\frac{1}{4}\right)</math></p> <p>✓ <math>\left(\frac{x-1}{4x-1}\right)</math></p> <p>✓ <math>\frac{1}{4} \times \frac{x-1}{4x-1}</math></p> <p>✓ equating to <math>\frac{7}{118}</math></p> <p>✓ answer (6)</p>

	<p><b>OR/OF</b></p> <p><math>P(\text{gift and gift}) = P(\text{gift at first draw}) \times P(\text{gift at second draw})</math></p> $\frac{7}{118} = \frac{1}{4} \times P(\text{gift at second draw})$ <p><math>P(\text{gift at second draw}) = \frac{7}{118} \div \frac{1}{4}</math></p> $= \frac{14}{59}$ <p>Therefore: <math>P(\text{gift at first draw}) = \frac{15}{60}</math></p> <p>And: 15 bags had mystery gifts inside</p>	<p><b>OR/OF</b></p> $\checkmark \frac{1}{4}$ $\checkmark \frac{1}{4} \times P(\text{gift at 2}^{\text{nd}} \text{ draw})$ $\checkmark \frac{7}{118} = \frac{1}{4} \times P(\text{gift at 2}^{\text{nd}} \text{ draw})$ $\checkmark \frac{14}{59}$ $\checkmark \frac{15}{60}$ $\checkmark \text{answer} \quad (6)$
		<b>[9]</b>

**TOTAL/TOTAAL: 150**