1.1. $2x(x+1) - 7(x+1) = 0$

$(x+1)(2x-7)$ ✔ $= 0$

$x = -1$ or $\frac{7}{2}$ ✔ ▷   **3**

1.2. $x^2 - 5x - 1 = 0$

$(\quad)(\quad) = 0$

$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
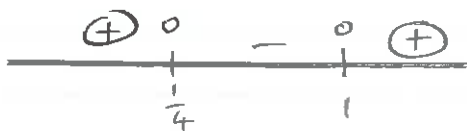
✔ $= \dfrac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-1)}}{2(1)}$

$= \dfrac{5 \pm \sqrt{29}}{2}$

✔ ✔

$= 5,19$ or $-0,19$ ▷   **3**

1.3. $4x^2 + 1 \geqslant 5x$

$4x^2 - 5x + 1 \geqslant 0$ ✔

$(x-1)(4x-1) \geqslant 0$ ✔

$x \leq \frac{1}{4}$ or $1 \leq x$

✔   ✔ ▷   **4**

1.4. $5^{4x+3} \cdot 100^{-2x+1} = 50\ 000$

$= 5^1 \cdot 100^2$

$4x + 3 = 1$ or $-2x + 1 = 2$

$x = -\frac{1}{2}$ $\qquad$ $x = -\frac{1}{2}$

$\therefore \underline{x = -\frac{1}{2}}$ ▷

(OR)

$100 = 5^2 \cdot 2^2$

$50\ 000 = 5^5 \cdot 2^4$

$5^{4x+3} \cdot (5^2 2^2)^{-2x+1} = 5^5 \cdot 2^4$

$5^{4x+3} \cdot 5^{-4x+2} \cdot 2^{-4x+2} = 5^5 \cdot 2^4$

$5^5 \cdot 2^{-4x+2} = 5^5 \cdot 2^4$

$\div 5^5 : \quad 2^{-4x+2} = 2^4$ ✔

$-4x + 2 = 4$

$x = -\frac{1}{2}$ ✔   **4**

1.5. $x = 2y$ ...1

$x^2 + 2x - y - y^2 = 36$ ... 2

$(2y)^2 + 2(2y) - y - y^2 = 36$ ✔

$4y^2 + 4y - y - y^2 = 36$

$3y^2 + 3y - 36 = 0$

$\div 3 : \quad y^2 + y - 12 = 0$ ✔

①

$(y+4)(y-3) = 0$ ✓ ✓ both

$y = -4$ or 3

$x = 2(-4)$ or $2(3)$

$= -8$ $= 6$ ✓ both

5

$\therefore$ $\underline{x = -8 \text{ and } y = -4}$

or

$\underline{x = 6 \text{ and } y = 3}$

1.6. $x^2 - kx + k - 1 = 0$

$\Delta = (-k)^2 - 4(1)(k-1)$ ✓

$= k^2 - 4k + 4$ ✓

$= (k-2)(k-2)$

$= (k-2)^2$ ✓

Now, if $k \in \mathbb{Q}$

- $\Delta \geqslant 0$

✓ $\therefore$ roots are $\underline{real}$

- $\Delta =$ perfect $\underline{square}$

$\therefore$ roots are $\underline{rational}$

4

2.1. $3 + 7 + 11 + \cdots + 483$

2.1.1. $a = 3$ $d = 4$

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

$= 3 + (n-1)(4)$

$= 3 + 4n - 4$

$= 4n - 1$

but $T_n = 483$

$\therefore$ ✓ $4n - 1 = 483$ ✓

$n = 121$ ✓   **3**

2.1.2. $\displaystyle\sum_{n=1}^{121}(4n-1)$ ✓   ✓ $\sum$ $4n-1$

or

$3 + (n-1)(4)$

2

2.2. $2t-4; \ t-3; \ 8-2t$

2.2.1. $t-3-(2t-4) \overset{✓}{=} 8-2t-(t-3)$

$t-3-2t+4 = 8-2t-t+3$

$-t+1 \overset{✓}{=} -3t+11$

$2t = 10$

$t = 5$ ✓   **3**

②

T_{10} ; T_{11} ; T_{12}

$2(5)-4$; $5-3$; $8-2(5)$

6 ; 2 ; -2

method ✔

$T_{10} = a + 9d$, d

$6 = a + 9(-4)$ ✔

$\underline{42 = a}$ ✔ ⟶   **3**

2.3. $T_1 + T_2 = -1$ $\qquad$ $T_3 + T_4 = -4$

$a + ar = -1$ ✔ $\qquad$ $ar^2 + ar^3 = -4$ ✔

$a(1+r) = -1$ $\qquad$ $ar^2(1+r) = -4$

$\cdots$ 1 $\qquad\qquad\qquad$ $\cdots$ 2

✔ cf, method

$(2) \div (1):$ $\dfrac{ar^2(1+r)}{a(1+r)} = \dfrac{-4}{-1}$

$r^2 = 4$

$r = \pm 2$

$\therefore$ $r = 2$ ✔ $(r > 0)$

$a(1+2) = -1$

$a = -\dfrac{1}{3}$ ✔

$\therefore$ $-\dfrac{1}{3}$; $-\dfrac{2}{3}$; $-\dfrac{4}{3}$ ✔ ⟶   **6**

---

3. $41; 43; 47; 53; 61$

$\underset{2}{\smile}\ \underset{4}{\smile}\ \underset{6}{\smile}\ \underset{8}{\smile}$

$\underset{2}{\smile}\ \underset{2}{\smile}\ \underset{2}{\smile}$ ✔

$d_2 = 2a$ $\quad$ $d_1 = 3a+b$ $\quad$ $T_1 = a+b+c$

$2 = 2a$ $\quad$ $2 = 3(1)+b$ $\quad$ $41 = 1-1+c$

$1 = a$ $\quad$ $-1 = b$ $\qquad$ $41 = c$

✔ $\qquad$ ✔ $\qquad$ ✔

$\therefore$ $\underline{T_n = n^2 - n + 41}$ ✔ ⟶   **5**

3.2. $T_{41} = (41)^2 - 41 + 41$

$= (41)^2$

$= 41 \cdot 41$

$(= 1681)$ ✔ value

1681 has factors of

41×41 ✔ fact and not

just 1 and itself

(1681) $\qquad$ ✔ def^n/conclusion

$\therefore$ $\underline{T_{41} \text{ is not prime}}$ ⟶   **3**

3.3. From the original given sequence the units digits are

✔ pattern

| 3 7 3 1 | 1 3 7 3 1 |

Groups of 5

T_1	$\frac{1}{5}$	0,2	1
T_2	$\frac{2}{5}$	0,4	3
T_3	$\frac{3}{5}$	0,6	7
T_4	$\frac{4}{5}$	0,8	3
T_5	$\frac{5}{5}$	1	1

✔ ÷5

$T_{49999998}$ $\dfrac{49\ 999\ 998}{5}$

$= 9\ 999\ 999,6$

$= \ldots,6$

∴ a 7 ✔ **3**

4.1.1. $A = P(1+i)^n$ ✔

$\checkmark = 500\ 000\left(1 + \dfrac{7,2}{1200}\right)^{12n}$

$\underline{^{503/_{500}} \checkmark \ \ \Rightarrow 1,006}$ **2**

4.1.2. $A = 500\ 000\left(\dfrac{503}{500}\right)^{60}$ ✔

$= R\ 715\ 894,21$ ✔

2

4.1.3. $A = 500\ 000\left(\dfrac{503}{500}\right)^{12n}$

$1\ 000\ 000 = $ ✔

$2 = \left(\dfrac{503}{500}\right)^{12n}$

$\dfrac{\log 2}{\log 503/500} = 12n$ ✔

$115,87\ldots =$

$9,65\ldots = n$

∴ 10 ✔ full years **3**

4.2.1. $i = \dfrac{15}{1200}$ ✔ $n = 36$

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

✔ $= \dfrac{10\ 000\left[1 - \left(1 + \frac{15}{1200}\right)^{-36}\right]}{15/1200}$

✔

$= 288\ 472,67\ldots$

∴ Deposit ✔

$= 350\ 000 - 288\ 472,67\ldots$

$= R\ 61\ 527,33$ ✔

5

④

4.2 $i = \dfrac{18,5}{1200}$ ✔

$n = 60$ ✔

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

$350\,000 = \dfrac{x\left[1-\left(1+\frac{18,5}{1200}\right)^{-60}\right]}{\frac{18,5}{1200}}$ ✔

$\underline{R\,8\,983,17 = x}$ ✔

4

5.

$y = x(x+3)$
$f = x^2 + 3x$

$y = -\frac{1}{2}x + 2$

g
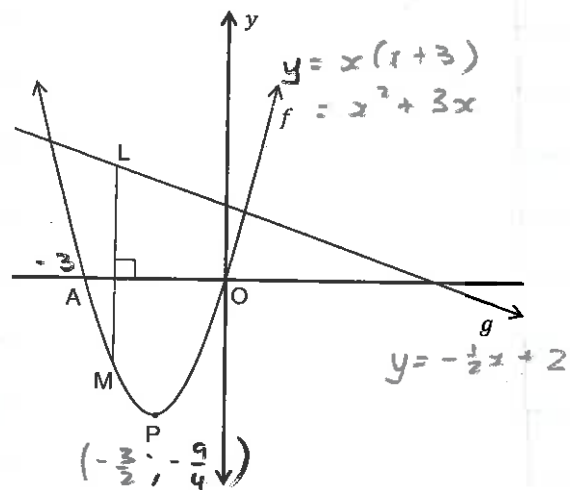
$P\left(-\frac{3}{2}; -\frac{9}{4}\right)$

$f: y = x^2 + 3x \qquad g: y = -\frac{1}{2}x + 2$

5.1 $x$int: $0 = x(x+3)$

$x = 0$ or -3

$\therefore \underline{A(-3; 0)}$ ✔ **1**

5.2 $x_{tp} = \dfrac{-3+0}{2}$ OR $\dfrac{-(3)}{2(1)}$

$= -\frac{3}{2}$ ✔

$y_{tp} = \left(-\frac{3}{2}\right)^2 + 3\left(-\frac{3}{2}\right)$ ✔

$= -\frac{9}{4}$

$\therefore \underline{P\left(-\frac{3}{2}; -\frac{9}{4}\right)}$ ✔ coord **3**

5.3 $f: \quad y = x^2 + 3x$

$x = -5 \quad y = (-5)^2 + 3(-5) = 10$

$\quad (-5; 10)$

✔ both pts

$x = -3 \quad y = (-3)^2 + 3(-3) = 0$

$\quad (-3; 0)$

Av grad $= \frac{\Delta y}{\Delta x}$

✔ $= \frac{10 - (0)}{-5 - (-3)}$

✔ $= -5$ → **3**

5.4. $f(x) > 0$

$y_f > 0$

$x \in (-\infty; -3)$ or $(0; \infty)$ → ✔ ✔ **2**

5.5. $f \quad 2 \to h$

✔ ✔

$(-\frac{3}{2}; -\frac{9}{4}) \longrightarrow (\frac{1}{2}; -\frac{9}{4})$ **2**

5.6. LM

$= y_L - y_M$

$= -\frac{1}{2}x + 2 - (x^2 + 3x)$ ✔

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

$= -x^2 - \frac{7}{2}x + 2$ ✔

✔ $= -[x^2 + \frac{7}{2}x + (+\frac{7}{4})^2 - \frac{49}{16}] + 2$

$= -[(x + \frac{7}{4})^2 - \frac{49}{16}] + 2$

✔ $= -(x + \frac{7}{4})^2 + \frac{49}{16} + 2$

$= -(x + \frac{7}{4})^2 + \frac{81}{16}$ → **4**

6.

h: $\quad y = 2^{-x}$

6.1. · exponential

· $\underline{y\,int}$: $y = 2^{-0}$

$= 1$

· $\underline{x\,int}$: $0 = 2^{-x}$

$\frac{\log 0}{\log 2} = -x$

no soln

∴ no x int

· $\underline{ha}$: $y = 0$

· other pt ·

$x = 1 \quad y = 2^{-1}$

$= \frac{1}{2}$

✔ yint
✔ decr   h
✔ ha

3

6.1.

$y = x$

h^{-1}

✔ xint
✔ shape + va

2

6.5.

⑥
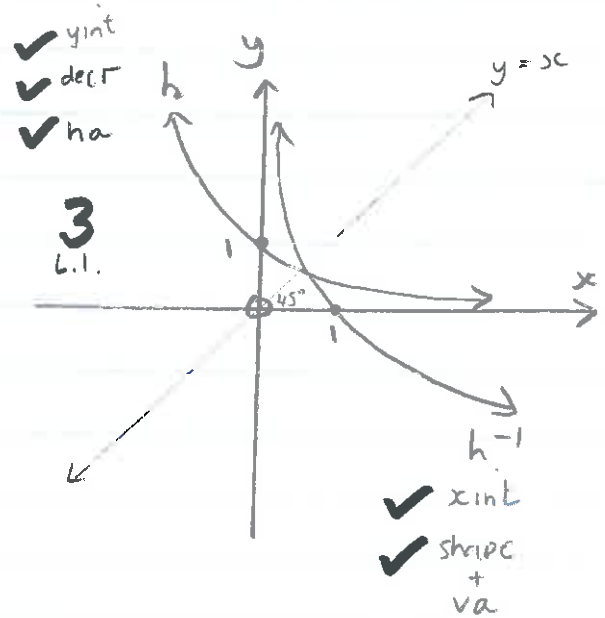
6.2. $y = 0$ x-axis

• $y \to -y$

• $x \to x$

h: $y = 2^{-x}$

g: $-y = 2^{-x}$

     $y = -2^{-x}$ ✔   **1**

6.3. h: $y = 2^{-x}$

h^{-1}: $x = 2^{-y}$ ✔

       $-y = \log_2 x$

       $y = -\log_2 x$ ✔ **2**

6.4. R_h: $y \in (0; \infty)$ ✔ **1**

6.5. h^{-1} : see graph

6.6. $h^{-1}(x) \geqslant -3$

     $y_{h^{-1}} \geqslant -3$
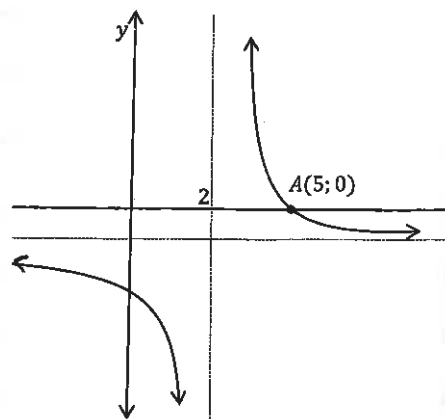
     $h^{-1}(x) = -3$

     $-\log_2 x = -3$

     $\log_2 x = 3$

       $2^3 = x$

     ✔ $8 =$

     ∴ $x \in (0; 8]$ ✔ **2**

7.

f: $y = \dfrac{d-x}{x-p}$

7.1. va: $x = 2$

     ∴ $x - 2 = 0$

     $y = \dfrac{d-x}{x-2}$

     Sub $A(5;0)$

     $0 = \dfrac{d-5}{5-2}$

     $0 = \dfrac{d-5}{3}$

   $\times 3$: $0 = d - 5$

       $5 = d$

     $y = \dfrac{d-x}{x-p}$

     $y = \dfrac{5-x}{x-2}$
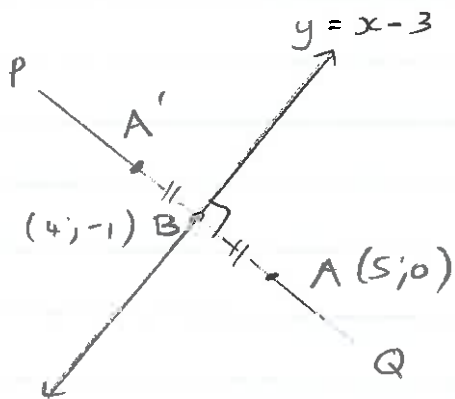
     ∴ $d = 5$ ✔ and $p = 2$ ✔ **2**

7.2. $y = \dfrac{5-x}{x-2}$

$$\begin{array}{r} -1 \;\checkmark \\ x-2 \;\overline{)\; -x+5} \\ \underset{\ominus}{\overset{\oplus}{-}}x \overset{\ominus}{+} 2 \\ \hline 3 \;\checkmark \end{array}$$

$\therefore y = -1 + \dfrac{3}{x-2}$

$= \dfrac{3}{x-2} - 1$ **2**

7.3.

$y = x - 3$

$m_{PQ} = -1$ $\perp$

$\therefore y = -x + c$

sub $A(5;0)$

$0 = -5 + C$

$5 = C$

$\therefore y = -x + 5$

$y = -x + 5$ $y = x - 3$

$-x + 5 = x - 3$

$8 = 2x$

$4 = x$

$\therefore y = -4 + 5$

$= 1$

$\therefore B(4; 1)$

$\dfrac{x+5}{2} = 4$ $\dfrac{y+0}{2} = 1$

$\times 2$

$x + 5 = 8$ $y = 2$

$x = 3$

$\therefore A'(3; 2)$ **2**

8.1. $f(x) = -2x^2 + p$

$f(x+h) = -2(x+h)^2 + p$ ✓

$\quad = -2(x^2 + 2xh + h^2) + p$

$\quad = -2x^2 - 4xh - 2h^2 + p$

$f'(x)$ ← must be shown

✓ $= \lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$

$= \lim\limits_{h \to 0} \dfrac{-2x^2 - 4xh - 2h^2 + p - (-2x^2 + p)}{h}$

$= \lim\limits_{h \to 0} \dfrac{-2x^2 - 4xh - 2h^2 + p + 2x^2 - p}{h}$

$= \lim\limits_{h \to 0} \dfrac{-4xh - 2h^2}{h}$ ✓ num

$= \lim\limits_{h \to 0} \dfrac{h(-4x - 2h)}{h}$

$= \lim\limits_{h \to 0} (-4x - 2h)$ ✓

$= -4x - 2(0)$ an only ✓s not ^{n} -1

$= -4x$ ✓   **5**

8.2. $D_x\left[4\sqrt[3]{x} + \dfrac{1}{3x} + 2 \right]$

$= D_x\left[4x^{\frac{1}{3}} + \dfrac{1}{3}x^{-1} + 2 \right]$ ✓ ✓

$= \dfrac{4}{3}x^{-\frac{2}{3}} - \dfrac{1}{3}x^{-2}$ **4**

✓   ✓

only,   only,   not ^{h}
CA if   CA if   -1
exp is   coef is a fraction
a   and
fraction   exponent is -

---

9. $f: y = (x-1)^2(x+3)$

$\quad = (x^2 - 2x + 1)(x + 3)$

$\quad = x^3 + 3x^2 - 2x^2 - 6x + x + 3$

✓ $= x^3 + x^2 - 5x + 3$

9.1. stat pt: $y' = 0$ NB

$3x^2 + 2x - 5 = 0$ ✓ =0

$(x-1)(3x+5) = 0$ ✓

$\therefore \quad x = 1 \text{ or } -\dfrac{5}{3}$ ✓ x's both

$x = 1 \quad : \quad y = 0$

$x = -\dfrac{5}{3} \quad : \quad y = \left(-\dfrac{5}{3} - 1\right)^2\left(-\dfrac{5}{3} + 3\right)$

$\quad = \dfrac{256}{27}$ ✓ y's both

$\therefore (1;0) \text{ and } \left(-\dfrac{5}{3}; \dfrac{256}{27}\right)$

$\quad -1,67 ◄ \quad \quad ↘ 9,48$

    5

9.2. $\cdot$ yint: $y = (0-1)^2(0+3)$

$\quad = 3$

$\cdot$ xint: $0 = (x-1)^2(x+3)$

$\therefore x = 1 \text{ or } -3$

$\cdot$ stat pt: $(1;0) \left(-\dfrac{5}{3}; \dfrac{256}{27}\right)$

$\cdot$ poi: $y'' = 0$

$6x + 2 = 0$

$x = -\dfrac{1}{3}$

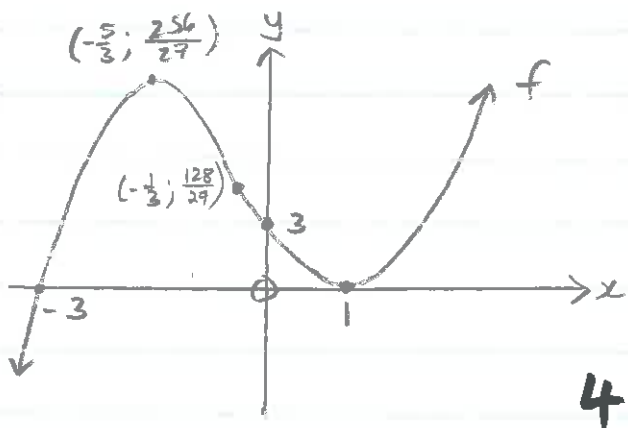$x = -\dfrac{1}{3} \quad y = \left(-\dfrac{1}{3} - 1\right)^2\left(-\dfrac{1}{3} + 3\right)$

$\quad = \dfrac{128}{27}$

$\therefore \left(-\dfrac{1}{3}; \dfrac{128}{27}\right)$

$\quad -0,33 ◄ \quad \quad ↘ 4,74$

shape $a = 1$ ∴ ⤴

✓ yint
✓ x ints
✓ stat pts
✓ shape ∿

$(-\frac{5}{3}; \frac{256}{27})$

$(-\frac{1}{3}; \frac{128}{29})$

3

-3

1

4

x ✓ y ✓ $f'' = 6x+2$ ✓

9.3. $(-\frac{1}{3}; \frac{128}{27})$

→ 4,74

(9.2.)

3

9.4. $f(x) = k$

$x^3 + x^2 - 5x + 3 = k$

$x^3 + x^2 - 5x + 3 - k = 0$

$x^3 + x^2 - 5x + 3 - k = y$

⏟ yint

∴ ↑↓

3 distinct real x ints

$3 - \frac{256}{27} < yint < 3$

$-\frac{175}{27} < 3-k < 3$

$-\frac{256}{27} < -k < 0$

$\frac{256}{27} > k > 0$

✓   ✓

2

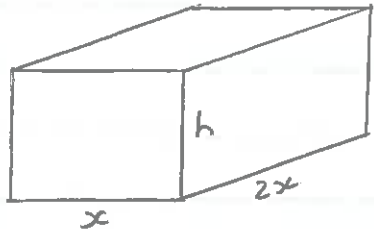
9.5. $m_{tan} = -5$

$y' = -5$

$3x^2 + 2x - 5 = -5$ ✓

$3x^2 + 2x = 0$

$x(3x+2) = 0$ ✓

$x = 0$ or $-\frac{2}{3}$

reject

poc: $x = -\frac{2}{3}$ ✓

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

$= \frac{175}{27}$ ✓

$y = -5x + C$

sub $(-\frac{2}{3}; \frac{175}{27})$

$\frac{175}{27} = -5(-\frac{2}{3}) + C$ ✓

$\frac{85}{27} = C$

∴ $y = -5x + \frac{85}{27}$ ✓

6

(10)

10.

10.1 TSA $= 2\boxed{}h + 2\boxed{}h + 2\boxed{}x$
$\qquad\quad\underset{x}{} \qquad \underset{2x}{} \qquad \underset{2x}{}$

$243 \,✓= 2xh + 2(2xh) + 2(2x.x)$

$243 = 2xh + 4xh + 4x^2$

$243 - 4x^2 = ✓\, 6xh$

$\dfrac{243}{6x} - \dfrac{4x^2}{6x} = h$

$\dfrac{81}{2x} - \dfrac{2x}{3} = h$ **2**

10.2. $V = A_b \times h$

$\quad = \boxed{} x \times h$
$\qquad \underset{2x}{}$

$\quad = 2x.x.h$ ✓

$\quad = 2x^2\left(\dfrac{81}{2x} - \dfrac{2x}{3}\right)$ ✓

$\quad = 81x - \dfrac{4}{3}x^3$ **2**

10.3 max : $\quad V' = 0$

$✓\; 81 - 4x^2 = 0$

$x^2 = \dfrac{81}{4}$ ✓

$x = \pm\dfrac{9}{2}$

$\quad = \dfrac{9}{2}$ ✓ cm

$\qquad\qquad 4,5$ **3**

11.1.

$\underline{} \quad \underline{} \quad \underline{} \quad \underline{} \quad \underline{}$
$\;\;9 \qquad 9 \qquad 9 \qquad 5 \qquad 4$
$\qquad\qquad ✓ \qquad\qquad ✓$

$\therefore 9 \times 9 \times 9 \times 5 \times 4$

$= 14\ 580$ ✓ **3**

11.2. FUNDAMENTALS

A : 2 ⑫

N : 2

11.2.1. $\dfrac{✓\,12\,!}{✓\,2!\,2!} = 119\ 750\ 400$ ✓ **3**

11.2.2. N $\underline{}\,\underline{}\,\underline{} \cdots \underline{}$ N
$\qquad\qquad\qquad ⑩$

$\therefore \dfrac{10\,!}{2\,!} = 1\ 814\ 400$ ✓

So, probability is

$\dfrac{1\ 814\ 400}{119\ 750\ 400}$ ✓ $\div$ by 119...

$= \dfrac{1}{66}$ ✓ **3**

11.3.   M : F = 1 : 2

let M = x
     F = 2x

11.3. 1.
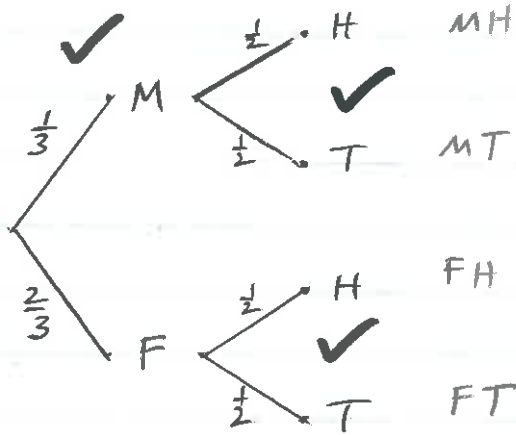
$\frac{1}{3}$, M $\begin{cases} \frac{1}{2} \cdot H & MH \\ \frac{1}{2} \cdot T & MT \end{cases}$

$\frac{2}{3}$, F $\begin{cases} \frac{1}{2} \cdot H & FH \\ \frac{1}{2} \cdot T & FT \end{cases}$

3

11.3. 2. P(F)
    = P(FH or FT)
    = $\frac{2}{3} \cdot \frac{1}{2} + \frac{2}{3} \cdot \frac{1}{2}$
    = $\frac{2}{3}$

1

11.3. 3. P(M H)
    = $\frac{1}{3} \cdot \frac{1}{2}$
    = $\frac{1}{6}$

an only   **2**
          2/2

**NATIONAL
SENIOR CERTIFICATE/
*NASIONALE
SENIOR SERTIFIKAAT***

GRADE/*GRAAD 12*

SEPTEMBER 2017

**MATHEMATICS P1/*WISKUNDE V1*
MEMORANDUM**

MARKS/*PUNTE:*   150

NOTE/LET OP:

- If a candidate answered a question TWICE, mark the FIRST attempt ONLY.
  Indien 'n kandidaat 'n vraag TWEE keer beantwoord het, merk SLEGS die EERSTE poging.
- Consistent accuracy applies in ALL aspects of the memorandum.
  Volgehoue akkuraatheid geld deurgaans in ALLE aspekte van die memorandum.
- If a candidate crossed out an attempt of a question and did not redo the question, mark the crossed-out attempt.
  Indien 'n kandidaat 'n poging vir 'n vraag deurgetrek het en nie die vraag weer beantwoord het nie, merk die poging wat deurgetrek is.
- The mark for substitution is awarded for substitution into the correct formula.
  Die punt vir substitusie word toegeken vir substitusie in die korrekte formule.

QUESTION 1/VRAAG 1

1.1	$2x(x + 1) - 7(x + 1) = 0$ $(x + 1)(2x - 7) = 0$ $x = -1$ or / *of* $x = \dfrac{7}{2}$	✓factors/*faktore* ✓x-value/*waarde* ✓x-value/*waarde* (3)
1.2	$x^2 - 5x - 1 = 0$ $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \dfrac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-1)}}{2(1)}$ $x = 5{,}19$ or $x = -0{,}19$	✓ substitution into correct formula/*substitusie in korrekte formule* ✓✓x-values/*waardes* (3)
1.3	$4x^2 + 1 \geq 5x$ $4x^2 - 5x + 1 \geq 0$ $(4x - 1)(x - 1) \geq 0$ $\begin{array}{c} + \quad\mid\quad - \quad\mid\quad + \\ \quad \frac{1}{4} \qquad\qquad 1 \end{array}$ $x \leq \dfrac{1}{4}$ or/ *of* $x \geq 1$	✓ standard form/*standaard vorm* ✓ factors/*faktore* ✓$x \leq \dfrac{1}{4}$ ✓$x \geq 1$ (4)
1.4	$5^{4x+3} . 100^{-2x+1} = 50\,000$ $5^{4x+3} . (5^2 . 2^2)^{-2x+1} = 50\,000$ $5^{4x+3} . 5^{-4x+2} . 2^{-4x+2} = 50\,000$ $5^5 . 2^{-4x} . 2^2 = 50\,000$ $2^{-4x} = 2^2$ $-4x = 2$ $x = -\dfrac{1}{2}$	✓5^{-4x+2} ✓2^{-4x+2} ✓$-4x = 2$ ✓ answer/*antwoord* (4)

       Please turn over

1.5	$x = 2y$ ....(1) $x^2 + 2x - y - y^2 = 36$.........(2) $x = 2y$ sub into (2)/vervang in (2) $(2y)^2 + 2(2y) - y - y^2 = 36$ $4y^2 + 4y - y - y^2 = 36$ $3y^2 + 3y - 36 = 0$ $y^2 + y - 12 = 0$ $(y - 3)(y + 4) = 0$ $y = 3$ or $y = -4$ $x = 6$ or $x = -8$	✓ substitution/*vervanging* ✓ standard form/*standaardvorm* ✓ factors/ *faktore* ✓y – values/ y – *waardes* ✓x – values/ x – *waardes* (5)
1.6	$x^2 - kx + k - 1 = 0$ $\Delta = b^2 - 4ac$ $\Delta = (-k)^2 - 4(1)(k - 1)$ $\Delta = k^2 - 4k + 4$ $\Delta = (k - 2)^2$ $\Delta \geq 0$ roots are real and rational(perfect square)	✓ substitution/*vervanging* ✓ simplification/*vereenvoudiging* ✓$(k - 2)^2$ ✓ conclusion/*gevolgtrekking* (4)
		[23]

QUESTION 2/*VRAAG 2*

2.1.1	$T_n = 4n - 1$ $483 = 4n - 1$ $484 = 4n$ $n = 121$ 121 terms in series/ *121 terme in reeks*	✓$T_n = 4n - 1$ ✓ equating/*gelykstelling* 483 ✓ answer/*antwoord* (3)
2.1.2	$\sum_{n=1}^{121} (4n - 1)$	✓✓ answer/*antwoord* (2)
2.2.1	$(t - 3) - (2t - 4) = (8 - 2t) - (t - 3)$ $-t + 1 = -3t + 11$ $2t = 10$ $t = 5$	✓ setting up equation/*opstel van vergelyking* ✓ simplification/*vereenvoudig* ✓ answer/*antwoord* (3)
2.2.2	...; ...; ... 6 ; 2 ; −2 ; ...; ...; ... $T_{10} = 6$ or /of $T_n = -4n + 46$ $a + 9d = 6$ $T_1 = -4(1) + 46$ $a + 9(-4) = 6$ $T_1 = 42$ $a = 42$	✓ numerical values of $T_{10}; T_{11}; T_{12}$/ *numeriese waardes van* $T_{10}; T_{11}; T_{12}$ ✓ difference / *verskil* −4 ✓ a-value/*a-waarde* (3)

2.3	$ar^2 + ar^3 = -4$ $a + ar = -1$ $\dfrac{ar^2(1+r) = -4}{a(1+r) = -1}$ $\therefore r^2 = 4$ $\therefore r = \pm 2$ $a + a(2) = -1$ $\therefore a + 2a = -1$ $3a = -1$ $a = -\dfrac{1}{3}$ First three terms: $-\dfrac{1}{3} \; ; -\dfrac{2}{3} \; ; -\dfrac{4}{3}$ *Eerste drie terme:*	✓✓ setting of equations/ *opstel van vergelykings* ✓ common factor/*gemene faktor* ✓$r = 2$ ✓ value of a/*waarde van a* ✓ first three terms/*eerste drie terme ry* (6)
		[17]

QUESTION 3/VRAAG 3

3.1	$41 \, ; \; 43 \, ; \; 47 \, ; \; 53 \, ; \; 61 \, ; \; 71 \, ; \; 83 \, ; \; 97 \, ; \; 113 \, ; \; 131$
	
	    2 4 6 8 10 12 14 16 18
	      2 2 2 2 2 2 2 2
	
	 $2a = 2$ $a + b = 2$ $a + b + c = 41$
	 $a = 1$ $b = -1$ $c = 41$
	       $\therefore T_n = n^2 - n + 41$
		✓ 2nd difference/ *tweede verskil*
		 ✓$a = 1$
		 ✓$b = -1$
		 ✓$c = 41$
		 ✓$T_n = n^2 - n + 41$
		 (5)

3.2	$T_{41} = 41^2 - 41 + 41$ $T_{41} = 1681$ Factors of 1681: 1 ; 41 and 1681 *Faktore van 1681 :* 1 ; 41 en 1681 1681 is not a prime number/ 1681 *is nie 'n priemgetal nie*	✓$T_{41} = 1681$ ✓ factors / *faktore* ✓ conclusion/ *gevolgtrekking* (3)
3.3	Consider the unit digits only/*kyk na die ene syfers alleenlik.* 1 ; 3 ; 7 ; 3 ; 1 ; 1 ; 3 ; 7 ; 3 ; 1 ; groups of 5/ *groepe van 5* $\dfrac{49999998}{5} = 9999999,6$ $0,6 \times 5 = 3$ $T_{49999998}$ will end in 7/ *sal met 'n 7 eindig*	✓ unit digits/*ene syfers* ✓ groups of 5/ *groepe van 5* ✓ conclusion/ *gevolgtrekking* (3)
		[11]

QUESTION 4/*VRAAG 4*

4.1.1	$A = P(1 + i)^n$ $A = 500\,000\left(1 + \dfrac{7,2}{1200}\right)^{12n}$ $A = 500\,000(1.006)^{12n}$	✓ sub into formula/ *vervang in formule* ✓$12n$ (2)
4.1.2	$\qquad A = 500\,000(1.006)^{12n}$ $A = 500\,000(1.006)^{12 \times 5}$ $A = R\,715894.21$	✓$n = 60$ ✓ answer/ *antwoord* (2)
4.1.3	$A = P(1 + i)^n$ $1000000 = 500000(1.006)^{12n}$ $12n = \dfrac{\log 2}{\log 1.006}$ $12n = 115.8707581$ $n = 9,66\ years$ Will exceed R1 000 000 in 10 years. *Sal R1 000 000 oorskry in 10 jaar.*	✓ setting up equation/*opstel van vergelyking* ✓using logs/ *gebruik van log* ✓conclusion/*gevolgtrekking* (3)
4.2.1	$P_v = \dfrac{10\,000\left[1 - \left(1 + \frac{15}{1200}\right)^{-36}\right]}{\frac{15}{1200}}$ $P_v = R288\,472,67$ $deposit/o = R350\,000 - R288\,472,67$ $deposit/o = R61\,527,33$	✓i and/*en* n ✓sub into P_v formula/ vervang in P_v formule ✓$P_v = R288\,472,67$ ✓subtracting/*aftrekking* ✓ answer/antwoord (5)
4.2.2	$350\,000 = \dfrac{x\left[1 - \left(1 + \frac{18,5}{1200}\right)^{-60}\right]}{\frac{18,5}{1200}}$ $x = R\,8\,983,17$	✓$i = \dfrac{18,5}{1200}$ ✓$n = \cancel{60}$ $n = 60$ X ✓ substitution/*substitusie* ✓ answer/*antwoord* (4)
		[16]

QUESTION 5/*VRAAG 5*
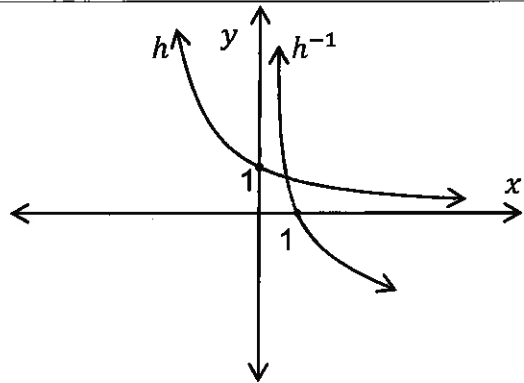
5.1	$A(-3; 0)$	$\checkmark$ answer/*antwoord* (1)
5.2	$f(x) = x^2 + 3x$ $x = -\dfrac{b}{2a}$ $x = -\dfrac{3}{2}$ $f\left(-\dfrac{3}{2}\right) = \left(-\dfrac{3}{2}\right)^2 + 3\left(-\dfrac{3}{2}\right)$ $\qquad = -\dfrac{9}{4}$ $P\left(-\dfrac{3}{2}; -\dfrac{9}{4}\right)$	$\checkmark x = -\dfrac{3}{2}$ $\checkmark$ substitution/ *vervanging* $\checkmark$ answer/ *antwoord* (3)
5.3	$f(-5) = 10 \quad$ and / *en* $\ f(-3) = 0$ $m = \dfrac{10 - 0}{-5 - (-3)}$ $m = -5$	$\checkmark$ calculating $f(-5)$ and $f(-3)$ *bepaling van* $f(-5)$ *en* $f(-3)$ $\checkmark$ substitution/*substitusie* $\checkmark$ m-value/*waarde* (3)
5.4	$x < -3$ or / *of* $x > 0$	$\checkmark\checkmark$ answer/ *antwoord* (2)
5.5	$P\left(-\dfrac{3}{2}; -\dfrac{9}{4}\right)$ $\left(-\dfrac{3}{2} \ominus 2; -\dfrac{9}{4}\right)$ $\left(\ominus\dfrac{+1}{2}; -\dfrac{9}{4}\right)$ **or/*of*** $f(x - 2) = (x - 2)(x - 2 + 3)$ $f(x - 2) = x^2 - x - 2$ $x = -\dfrac{(-1)}{2(1)}$ $x = \ominus\dfrac{+1}{2}$	$\checkmark\checkmark$ answer/ antwoord $\quad X$ $\checkmark f(x - 2) = x^2 - x - 2$ $\checkmark x = \ominus\dfrac{+1}{2} \quad X$ (2)

5.6	$LM = -\dfrac{1}{2}x + 2 - (x^2 + 3x)$	✓ $g(x) - f(x)$
	$LM = -\dfrac{1}{2}x + 2 - x^2 - 3x$	✓ standard form/*standaardvorm*
	$LM = -x^2 - \dfrac{7}{2}x + 2$	
	$LM = -\left(x^2 + \dfrac{7}{2}x - 2\right)$	✓ completing the square/ *voltooing van kwadraat*
	$LM = -\left[\left(x + \dfrac{7}{4}\right)^2 - \dfrac{81}{16}\right]$	✓ answer/*antwoord*
	$LM = -\left(x + \dfrac{7}{4}\right)^2 + \dfrac{81}{16}$	

OR/*OF*

$LM = -\dfrac{1}{2}x + 2 - (x^2 + 3x)$ ✓ $g(x) - f(x)$

$LM = -\dfrac{1}{2}x + 2 - x^2 - 3x$ ✓ standard form/*standaardvorm*

$LM = -x^2 - \dfrac{7}{2}x + 2$

$\dfrac{dLM}{dx} = -2x - \dfrac{7}{2}$ ✓ $x = -\dfrac{7}{4}$

$-2x - \dfrac{7}{2} = 0$

$x = -\dfrac{7}{4}$

$y = -\left(-\dfrac{7}{4}\right)^2 - \dfrac{7}{2}\left(-\dfrac{7}{4}\right) + 2$ ✓ $y = \dfrac{81}{16}$

$y = \dfrac{81}{16}$

$\therefore LM = -\left(x + \dfrac{7}{4}\right)^2 + \dfrac{81}{16}$

OR/*OF*

$x = -\dfrac{b}{2a}$ ✓ $g(x) - f(x)$

    ✓ standard form/*standaardvorm*

$x = -\dfrac{-\dfrac{7}{2}}{2(-1)}$

$x = -\dfrac{7}{4}$ ✓ $x = -\dfrac{7}{4}$

$y = -\left(-\dfrac{7}{4}\right)^2 - \dfrac{7}{2}\left(-\dfrac{7}{4}\right) + 2$

$y = \dfrac{81}{16}$ ✓ $y = \dfrac{81}{16}$

$\therefore LM = -\left(x + \dfrac{7}{4}\right)^2 + \dfrac{81}{16}$

(4)

[15]

QUESTION 6/*VRAAG 6*

6.1		✓shape / vorm ✓$y - $intercept/ $y - afsnit$ ✓ point on graph/*punt op grafiek* (3)
6.2	$q(x) = \boxed{2^x}$ $y = -2^{-x}$	✓ answer/*antwoord* (1)
6.3	$$h^{-1}x = 2^{-y}$$ $$-y = \frac{\log x}{\log 2}$$ $$y = -\frac{\log x}{\log 2} \;/\; y = -\log_2 x \;/\; y = \log_{\frac{1}{2}} x$$	✓ interchange x and y *ruil x en y* ✓ equation/*vergelyking* (2)
6.4	$y \geq 0 \,; y \in R$ $y > 0$	(1)
6.5	See ~~7.2.1/sien 7.2.1~~ 6.1.	✓✓shape and x-intercept/*vorm en x-afsnit* (2)
6.6	$$\log_{\frac{1}{2}} x = -3$$ $$\left(\frac{1}{2}\right)^{-3} = x$$ $$x = 8$$ $$\therefore \quad 0 < x \leq 8$$	✓$x = 8$ ✓$0 < x \leq 8$ (2)
		[11]

            Please turn over

QUESTION 7/*VRAAG 7*

7.1	$d = 5$ $p = 2$	$\checkmark d = 5$ $\checkmark p = 2$ (2)
7.2	$y = \dfrac{5 - x}{x - 2}$ $y = \dfrac{-(x - 2) + 3}{(x - 2)}$ $y = \dfrac{3}{x - 2} - 1$	$\checkmark y = \frac{5-x}{x-2}$ $\checkmark y = \frac{-(x-2)+3}{(x-2)}$ (2)
7.3	$A(5; 0)$ $y = x - 3$ $x = y + 3$ $A'(0 + 3; 5 - 3)$ $A'(3; 2)$	$\checkmark x = 3$ $\checkmark y = 2$ (2)
		[6]

Please turn over

QUESTION 8/VRAAG 8

8.1	$f(x) = -2x^2 + p$	
	$f'(x) = \lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$	✓ formula/*formule*
	$= \lim\limits_{h \to 0} \dfrac{-2(x+h)^2 + p - (-2x^2 + p)}{h}$	✓ substitution of/*substitusie van* $(x + h)$
	$= \lim\limits_{h \to 0} \dfrac{-2(x^2 + 2xh + h^2) + p + 2x^2 - p)}{h}$	
	$= \lim\limits_{h \to 0} \dfrac{-2x^2 - 4xh - 2h^2 + p + 2x^2 - p}{h}$	✓ simplification to/ *vereenvoudiging na* $(-4xh - 2h^2)$
	$= \lim\limits_{h \to 0} \dfrac{-4xh - 2h^2}{h}$	
	$= \lim\limits_{h \to 0} \dfrac{h(-4x - 2h)}{h}$	✓ common factor/*gemene faktor*
	$= \lim\limits_{h \to 0}(-4x - 2h)$	
	$= -4x$ \boxed{\text{Answer ONLY: 0 marks/ \textit{SLEGS antwoord: 0 punte}}}	✓ answer/*antwoord*
	\boxed{\begin{array}{l}\text{Penalise 1 mark for incorrect use of}\\ \text{formula. Must show } f'(x).\\ \textit{Penaliseer 1 punt vir verkeerde gebruik van}\\ \textit{formule. Moet } f'(x) \textit{ toon.}\end{array}}	
		(5)
8.2	$D_x\left[4\sqrt[3]{x} + \dfrac{1}{3x} + 2\right]$	
	$D_x\left[4x^{\frac{1}{3}} + \dfrac{1}{3}x^{-1} + 2\right]$ \boxed{\begin{array}{l}\text{Penalise 1 mark for}\\ \text{incorrect notation. /}\\ \textit{Penaliseer 1 punt vir}\\ \textit{verkeerde notasie.}\end{array}}	✓ $4x^{\frac{1}{3}}$ ✓ $\dfrac{1}{3}x^{-1}$
	$= \dfrac{4}{3}x^{-\frac{2}{3}} - \dfrac{1}{3}x^{-2}$	✓ $\dfrac{4}{3}x^{-\frac{2}{3}}$ ✓ $-\dfrac{1}{3}x^{-2}$
		(4)
		[9]

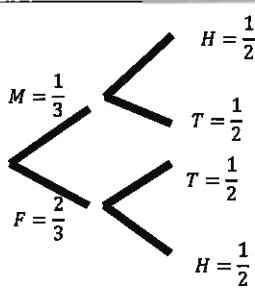## QUESTION 9/VRAAG 9

9.1	$f(x) = (x-1)^2(x+3)$ $f(x) = x^3 + x^2 - 5x + 3$ $f'(x) = 3x^2 + 2x - 5$ $3x^2 + 2x - 5 = 0$ $(3x+5)(x-1) = 0$ $x = -\dfrac{5}{3}$ or / of $x = 1$ $f(1) = 0$ $f\left(-\dfrac{5}{3}\right) = \dfrac{256}{27}$	✓ $f(x) = x^3 + x^2 - 5x + 3$ ✓ $f'(x) = 0$ ✓ factors/*faktore* ✓ x-values/*waardes* ✓ y-values/*waardes* (5)
9.2		✓ shape / vorm ✓ x – intercepts/x – *afsnitte* ✓ y – intercept/y – *afsnit* ✓ stationary points/*draaipunte* (4)
9.3	$f''(x) = 6x + 2$ $6x + 2 = 0$ $x = -\dfrac{1}{3}$ $y = \dfrac{128}{27}$ / 4,74 / $4\dfrac{20}{27}$	✓ $f''(x) = 6x + 2$ ✓ $x = -\dfrac{1}{3}$ ✓ $y = \dfrac{128}{27}$ / 4,74 / $4\dfrac{20}{27}$ (3)
9.4	$0 < k < \dfrac{256}{27}$	✓✓ answer (2)
9.5	$f'(x) = 3x^2 + 2x - 5$ $3x^2 + 2x - 5 = -5$ $3x^2 + 2x = 0$ $x(3x+2) = 0$ $x = 0$ or/of $x = -\dfrac{2}{3}$ $f\left(-\dfrac{2}{3}\right) = \dfrac{175}{27}$ $y = -5x + c$ $\dfrac{175}{27} = -5\left(-\dfrac{2}{3}\right) + c$ $c = \dfrac{85}{27}$ $y = -5x + \dfrac{85}{27}$	✓ $f'(x) = -5$ ✓ factors/ *faktore* ✓ $x = -\dfrac{2}{3}$ ✓ $f\left(-\dfrac{2}{3}\right) = \dfrac{175}{27}$ ✓ substitution/*vervanging* ✓ answer/*antwoord* (6)
		[20]

QUESTION 10/*VRAAG 10*

10.1	$243 = 2(x \times 2x) + 2(2x \times h) + 2(x \times h)$ $243 = 4x^2 + 4xh + 2xh$ $243 = 4x^2 + 6xh$ $h = \dfrac{243 - 4x^2}{6x}$ $h = \dfrac{81}{2x} - \dfrac{2x}{3}$	✓TSA equation and sub/ *TOA vergelyking met vervanging* ✓simplification/ *vereenvoudiging* (2)
10.2	$V = 2x \times x \times \left(\dfrac{81}{2x} - \dfrac{2x}{3}\right)$ $V = 81x - \dfrac{4}{3}x^3$	✓ formula $2x \cdot x \cdot h$ ✓ sub into volume formula/ *vervanging in volume formule* (1)
10.3	$\dfrac{dV}{dx} = 81 - 4x^2$ $81 - 4x^2 = 0$ $x^2 = \dfrac{81}{4}$ $x = \dfrac{9}{2} = 4.5$	✓$81 - 4x^2$ ✓$81 - 4x^2 = 0$ ✓$x^2 = \dfrac{81}{4}$ ✓answer/*antwoord* (4)
		[7]

$+1$

-1

QUESTION 11/*VRAAG 11*

11.1	$9 \times 9 \times 9 \times 5 \times 4 = 14580$	✓$9 \times 9 \times 9$ ✓5×4 ✓ 14580 (3)
11.2.1	$\dfrac{12!}{2!.2!} = 119750400$	✓ $12!$ ✓$2!.2!$ ✓ 119750400 (3)
11.2.2	$\dfrac{\frac{10!}{2!}}{119750400} = \dfrac{1}{66} = 0,015$	✓$\frac{10!}{2!}$ ✓ 119750400 ✓ answer/*antwoord* (3) **[9]**
11.3.1		✓ first branch with values/ *eerste tak met waardes* ✓ top part of second branch with values / *boonste gedeelte van tweede tak met waardes* ✓ bottom part of second branch with values / *onderste gedeelte van tweede tak met waardes* (3)
11.3.2	$P(F) = \dfrac{2}{3}$	✓$P(F) = \frac{2}{3}$ (1)
11.3.3	$P(M/H) = \dfrac{1}{3} \times \dfrac{1}{2}$ $P(M/H) = \dfrac{1}{6}$	✓✓$P(M/H) = \frac{1}{6}$ (2)
		[15]
		TOTAL/*TOTAAL*: 150