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Western Cape Government
Education
FOR YOU

CAPE WINELANDS EDUCATION DISTRICT

MATHEMATICS PAPER 1
GRADE 12

COMMON PRELIMINARY EXAMINATION
SEPTEMBER 2024

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MARKS: 150

TIME: 3 hours

This exam paper consists of 10 pages and 1 information sheet.

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 10 questions.
2. Answer ALL the questions.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Clearly show ALL calculations, diagrams, graphs, etc. that you have used in determining your answers.
5. Answers only will NOT necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. If necessary, round off answers to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. An information sheet with formulae is included at the end of the question paper.
10. Write neatly and legibly.

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QUESTION 1

1.1 Solve for x:

1.1.1 $(x-1)(2x-6)=0$ (2)

1.1.2 $x^2-7x-7=0$ (answers correct to TWO decimal places) (3)

1.1.3 $6x^2+7x>5$ (4)

1.1.4 $1=\dfrac{-6}{\sqrt{x+2}}+\sqrt{x+2}$ (5)

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1.2 Solve for x and y simultaneously:

$$6y+2x=4 \quad \text{and} \quad x^2+xy=4$$ (6)

1.3 Simplify, without the use of a calculator:

$$\sqrt{3}.\sqrt{48}-\frac{4^{x+1}}{2^{2x}}$$ (3)

1.4 Given: $f(x)=3(x-1)^2+5$ and $g(x)=3$

1.4.1 Is it possible for the graphs of f and g to intersect? Give a reason for your answer. (2)

1.4.2 Determine the value(s) of k for which $f(x)=g(x)-k$ has TWO unequal real roots. (4)

[29]

QUESTION 2

2.1 On the first day Brett played an online game for 12 minutes. The second day he played for 12 minutes longer than the previous day. He kept on increasing the time each day.

The record of the time he spent per day is given in the table below:

DAY	1	2	3	4	5
TIME	12	24	40	a	b

If the time spent playing the game forms a quadratic sequence, determine:

2.1.1 the values of a and b. (2)

2.1.2 a formula for the time spent on the n^{th} day. (4)

2.1.3 on which day he played for 312 minutes. (4)

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2.2 Given: $S_\infty = \sum_{k=1}^{\infty} 4p^{1-k}$, $p \neq 0$

2.2.1 Calculate the value of p, if it is given that $S_\infty = 3$. (4)

2.2.2 Is this series convergent? Explain your answer. (2)

2.3 An arithmetic series has a common difference of 3. The third and sixth terms of the series are respectively $\frac{3x-4}{2}$ and $\frac{-3x-10}{2}$.

2.3.1 Show that the value of $x = -4$. (2)

2.3.2 Hence, calculate the first term of the series. (3)

2.3.3 Determine the sum of the second set of 30 terms of this series. (4)

[25]

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QUESTION 3

Given: $f(x) = \frac{2}{x-3} - 1$ and $g(x) = x - 3$

3.1 Write down the domain of f. (1)

3.2 Calculate the x-intercept of f. (2)

3.3 Draw the graphs of f and g on the same system of axes. Clearly show all the intercepts with the axes as well as the asymptotes. (5)

3.4 Calculate the value(s) of x for which $f(x) \geq g(x)$ if $x \geq 3$. (4)

[12]

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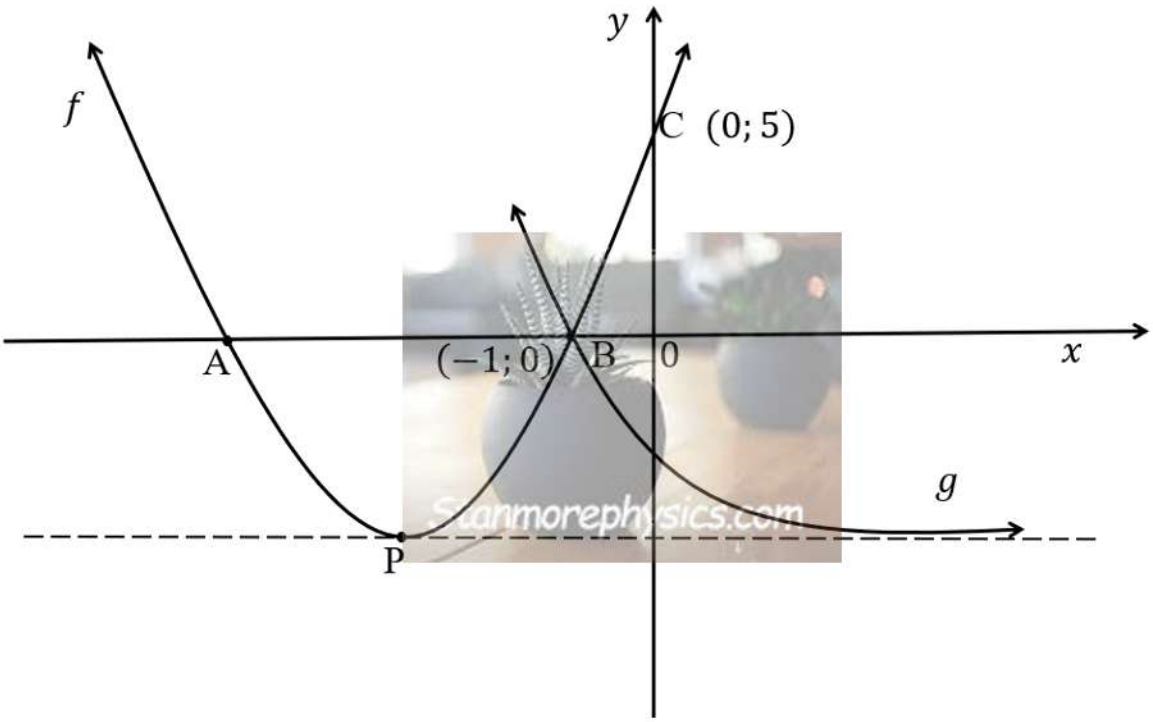
QUESTION 4

The graphs of the functions $f(x) = a(x+3)^2 + q$ and $g(x) = m^{-x} + k$ are drawn below.

- A and B$(-1; 0)$ are the x-intercepts of f.
- C$(0; 5)$ is the y-intercept of f.
- P is the turning point of f.
- The graphs intersect at B$(-1; 0)$.
- The asymptote of g is a tangent to f at the turning point P of f.



4.1 Write down the equation of the axis of symmetry of the parabola f. (1)

4.2 Determine the equation of f in the form $y = ax^2 + bx + c$. (4)

4.3 Hence, show that the equation of the asymptote of g is given by $y = -4$.
Clearly show all your calculations. (1)

4.4 Determine the value of x for which $f'(x).g(x) > 0$ (2)

4.5 The graph g is shifted 4 units upwards to give a new function h.
Determine the equation of h^{-1}, the inverse of h, in the form $y =$ ..... (4)
[12]

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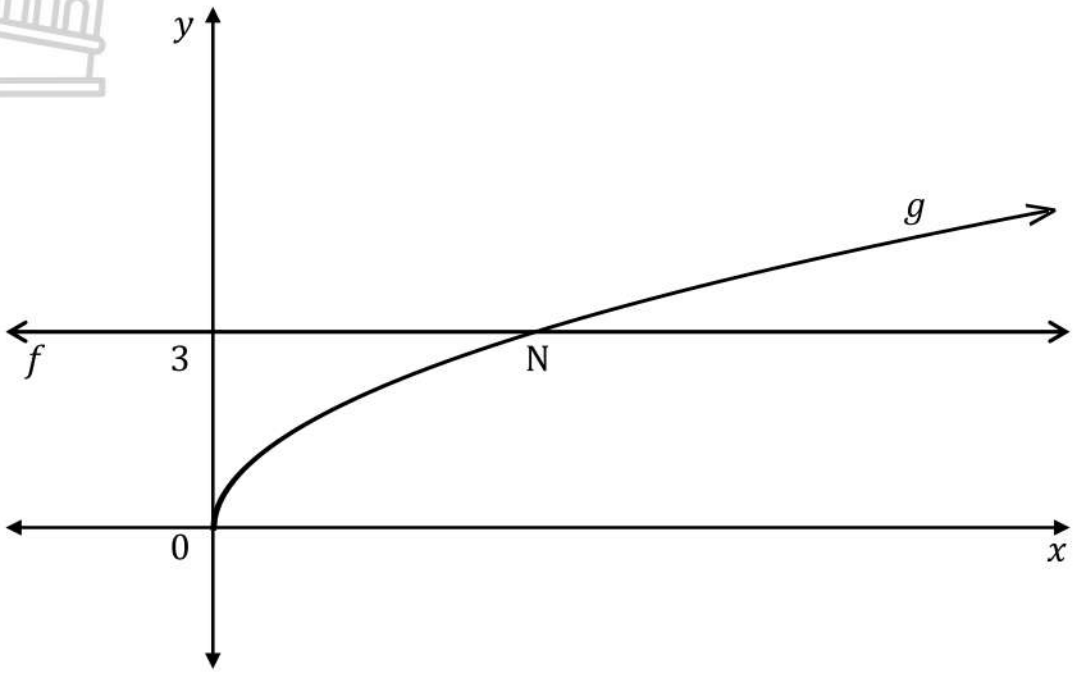
QUESTION 5

In the diagram, the graphs of $f(x) = 3$ and $g(x) = \sqrt{x}$ for $x \geq 0$ are given.

- The y-intercept of f is $(0; 3)$ and
- N is the point of intersection of the graphs.



5.1 Give the range of g^{-1}. (1)

5.2 Determine the coordinates of N. (2)

5.3 Determine the equation of the reflection of g in the line $y = x$ in the form $y =$…….. (3)

[6]

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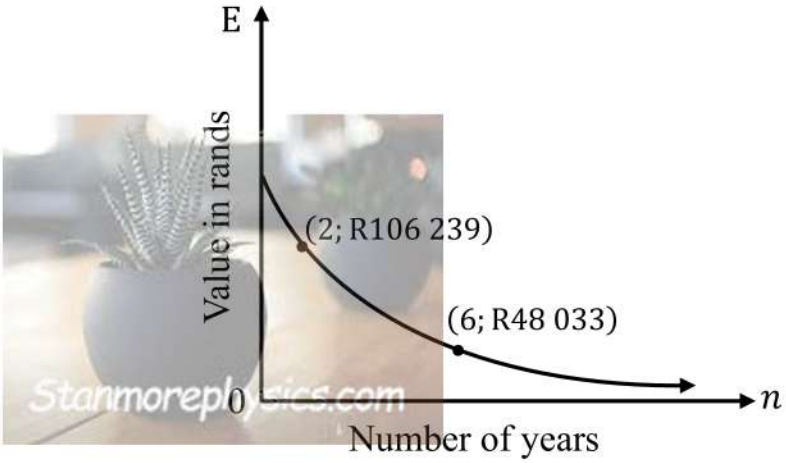
QUESTION 6

6.1 Determine how long it will take for an investment of R20 000 to grow to R45 000 in an account earning interest at 7,5% p.a., compounded monthly. Give your answer to the nearest month. (3)

6.2 The depreciation of office equipment is represented by the graph below.
E is the value of the equipment in Rands and n is the number of years the equipment is being used.



6.2.1 What does the y-intercept of the graph indicate? (1)

6.2.2 According to this model, will the value of the equipment ever become R0? Explain your answer. (1)

6.2.3 Calculate the annual rate of depreciation. (3)

6.3 Herman plans to purchase a house for R2 464 000. He will take out a loan for the full amount for 30 years at 10,2% p.a., compounded monthly.

6.3.1 Calculate what his instalments will be if he is required to repay the bank equal amounts at the end of each month. (4)

6.3.2 Instead of paying the bank-stipulated amount calculated in QUESTION 6.3.1, Herman decides to repay the loan by R22 500 instead, at the end of every month. Calculate the balance outstanding on the loan immediately after he pays his 84th payment. (3)

[15]

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QUESTION 7

7.1 Determine $f'(x)$ from first principles if $f(x) = -3x^2 + 7$. (5)

7.2 Determine $\frac{dy}{dx}$ for each of the following:

7.2.1 $y = 8\sqrt{x} - \sqrt{21}$ (3)

7.2.2 $x^2y = 2x^3 + 4 \; ; \; x \neq 0$ (4)

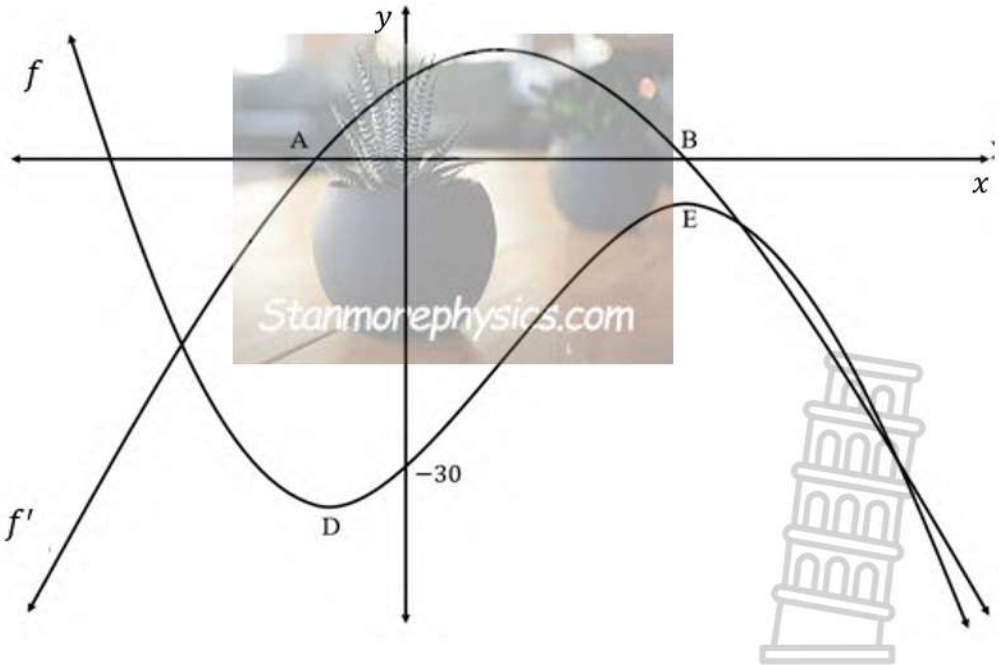
7.3 Calculate the value of the constant h so that the curve of $y = hx + x^3$ will have a local maximum at $x = -1$. (3)

[15]

QUESTION 8

The diagram below shows the curves of $f(x) = ax^3 + bx^2 + cx + d$ and $f'(x) = -3x^2 + 6x + 9$

- The graph of $f'(x) = -3x^2 + 6x + 9$ intersects the x-axis at A and B.
- D and E are the stationary points of the cubic graph $f(x) = ax^3 + bx^2 + cx + d$.
- -30 is the y-intercept of f.



8.1 Determine the x-coordinates of D and E. Show all your calculations. (3)

8.2 Determine the equation of f. (5)

8.3 Determine the value(s) of x for which f is increasing. (2)

8.4 For which values of x is the graph of f concave down? (3)

[13]

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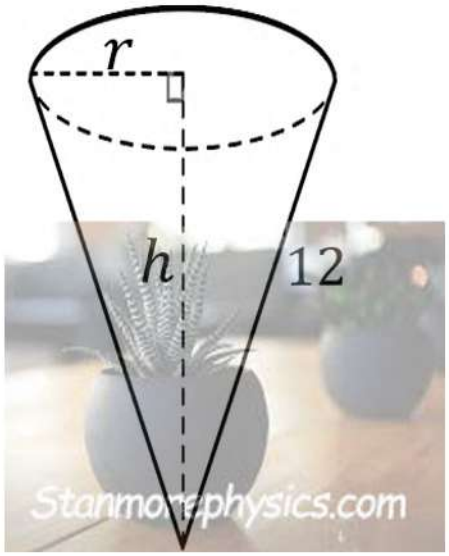
QUESTION 9

The flowerpot below is in the shape of a cone.

- r is the radius of the base and h is the perpendicular height of the cone.
- The slant height of the cone is 12 cm.



Formulae for volume:			
$V = lbh$	$V = \pi r^2 h$	$V = \frac{1}{3}\pi r^2 h$	$V = \frac{4}{3}\pi r^3$

9.1 Show that the volume of the water needed to fill the entire flowerpot can be expressed as:

$$V = 48\pi h - \frac{1}{3}\pi h^3$$ (3)

9.2 The gardener wants to maximize the volume of water in the flowerpot.
Determine the value of h for which the volume is a maximum. (3)
[6]

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QUESTION 10

10.1 A survey was conducted about the broadcasting of the Olympic games on the television. 150 males and 100 females were interviewed to establish if they liked the broadcasting or not. The table below shows some of the results:

	MALE	FEMALE	TOTAL
Like the broadcasting	60	70	130
Did not like the broadcasting	(a)	30	(b)
TOTAL	150	100	250

10.1.1 Calculate the values of (a) and (b). (2)

10.1.2 Calculate the probability that if a person is chosen randomly that he will be a male that liked the broadcasting. (1)

10.1.3 Determine whether a person's preference for the broadcasting is independent of the person's gender. Support your answer with appropriate calculations. (4)

10.2 Three friends from England, Mark, John and Michael, are to swim in the 100 m butterfly race which has eight swimmers in total. The eight swimmers line up one to a lane and the lanes are numbered 1 to 8.

10.2.1 Write down the total possible number of arrangements at the starting blocks. (1)

10.2.2 Determine the probability that Mark will be in lane 1, John in lane 2 and Michael in lane 3. (3)

10.3 A company uses a coding system to identify its clients. Each code consists of two letters and a sequence of digits, for example:
AB 206 or CC 456789

- The letters are chosen from A, B, C, D and E.
  Letters may be repeated in the code.
- The digits 0 to 9 are used.
  NO digit may be repeated in the code.
  The digit part of the code may not begin with a zero (0)

10.3.1 How many different clients can be identified with a coding system made up of TWO letters and TWO digits? (2)

10.3.2 Determine the least number of digits that is required for a company to uniquely identify 680 000 clients using their coding system (4)
[17]

TOTAL: 150

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INFORMATION SHEET: MATHEMATICS

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

$$A = P(1+ni) \qquad A = P(1-ni) \qquad A = P(1-i)^n \qquad A = P(1+i)^n$$

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

$$T_n = ar^{n-1} \qquad S_n = \frac{a(r^n - 1)}{r-1} \;;\; r \neq 1 \qquad S_\infty = \frac{a}{1-r} \;;\; -1 < r < 1$$

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

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

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c \qquad y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1} \qquad m = \tan\theta$$

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

In ΔABC:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

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

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

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

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

$$P(A) = \frac{n(A)}{n(S)} \qquad P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\hat{y} = a + bx \qquad b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$$

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MATHEMATICS

GR12

MARKING GUIDELINE-FINAL

MARKS: 150

TIME: 3 hours

- ✓ **ONLY penalise for rounding in Q1.1.2**
- ✓ **CALCULUS ONLY penalise for notation in Q7.1**

NOTE:

• If a candidate answers a question TWICE, only mark the FIRST attempt.

• If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed-out version.

• Consistent accuracy applies in ALL aspects of the marking memorandum. Stop marking at the second calculation error.

• Assuming answers/values in order to solve a problem is NOT acceptable.

NOTA:

• As 'n kandidaat 'n vraag TWEE KEER beantwoord, sien slegs die EERSTE poging na

. • As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, sien die doodgetrekte poging na.

• Volgehoue akkuraatheid word in ALLE aspekte van die nasienriglyne toegepas. Hou op nasien by die tweede berekeningsfout.

• Om antwoorde/waardes te aanvaar om 'n probleem op te los, word NIE toegelaat NIE.

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QUESTION 1

1.1.1	$(x-1)(2x-6)=0$ $x=1$ or $x=3$	✓ $x=1$ ✓ $x=3$ (2) Accept $\frac{6}{2}$
1.1.2	$x^2-7x-7=0$ $x=\frac{-(-7)\pm\sqrt{(-7)^2-4(1)(-7)}}{2(1)}$ $=\frac{7\pm\sqrt{77}}{2}$ $=7{,}89$ or $-0{,}89$ -1 if rounding is incorrect.	✓ Substitution ✓ 7,89 ✓ $-0{,}89$ AO full marks (3)
1.1.3	$6x^2+7x>5$ $6x^2+7x-5>0$ $(3x+5)(2x-1)>0$ $x<-\frac{5}{3}$ or $x>\frac{1}{2}$	✓ Standard form ✓ Factors / formula ✓ $x<-\frac{5}{3}$ ✓ $x>\frac{1}{2}$ AO *full marks* (4) • Learners must be penalised if they use the word *and* (and not or) • They may use a ; • Loose one mark if include = sign
1.1.4	$1=\frac{-6}{\sqrt{x+2}}+\sqrt{x+2}$ $\sqrt{x+2}=-6+x+2$ or $k=-6+k^2$ $\sqrt{x+2}=x-4$ $x+2=x^2-8x+16$ $0=x^2-9x+14$ $0=(x-7)(x-2)$ $x=7$ or $x\neq 2$	✓ Multiply by $\sqrt{x+2}$ ✓ square both sides ✓ standard form ✓ $x=7$ ✓ $x\neq 2$ (5)

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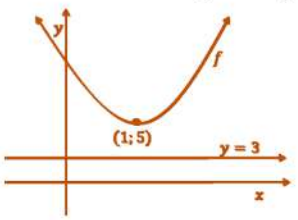
1.2	$6y + 2x = 4$ $x = 2 - 3y$ $x^2 + xy = 4$ $(2 - 3y)^2 + y(2 - 3y) = 4$ $4 - 12y + 9y^2 + 2y - 3y^2 = 4$ $6y^2 - 10y = 0$ $2y(3y - 5) = 0$ $y = 0$ or $y = \frac{5}{3}$ $x = 2$ or $x = -3$ $y = \frac{-(-10) \pm \sqrt{(10)^2 - 4(6)(0)}}{2(6)}$ **OR** $y = \frac{2 - x}{3}$ $x^2 + x\left(\frac{2 - x}{3}\right) = 4$ $3x^2 + x(2 - x) = 12$ $3x^2 + 2x - x^2 = 12$ $2x^2 + 2x - 12 = 0$ $x^2 + x - 6 = 0$ $(x - 2)(x + 3) = 0$ $x = 2$ or $x = -3$ $y = 0$ or $y = \frac{5}{3}$ $x = \frac{-(1) \pm \sqrt{(1)^2 - 4(1)(-6)}}{2(1)}$	✓ x subject of formula ✓ Subst. ✓ standard form ✓ factors / formula ✓ both y values ✓ both x values (6) **OR** ✓ y subject of formula ✓ Subst. ✓ standard form ✓ factors / formula ✓ both x values ✓ both y values (6)
1.3	$\sqrt{3}.\sqrt{48} - \frac{4^{x+1}}{2^{2x}}$ $= \sqrt{3}.4\sqrt{3} - \frac{2^{2x+2}}{2^{2x}}$ $= 12 - 4$ $= 8$ **OR** $\sqrt{3}.\sqrt{48} - \frac{4^{x+1}}{2^{2x}}$ $= \sqrt{144} - \frac{2^{2x+2}}{2^{2x}}$ $= 12 - 4$ $= 8$	✓ 2^{2x+2} ✓ 4 ✓ Answer (3) **OR** ✓ 2^{2x+2} ✓ 4 ✓ Answer (3)
1.4.1	No, there will be no intersection between the graphs. Min value of $3(x - 1)^2 + 5$ is 5  	✓ answer ✓ reason (2)

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	OR $3(x-1)^2+5=3$ $3(x-1)^2=-2$ $(x-1)^2 \neq \frac{-2}{3}$ No, there will be no intersection between the graphs. **OR** $3(x-1)^2+5=3$ $3(x^2-2x+1)+2=0$ $3x^2-6x+5=0$ $\Delta=(-6)^2-4(3)(5)$ $\Delta=-24$ $\Delta<0$ No, there is no solution to the equation $f(x)=g(x)$	**OR** ✓ reason ✓ answer (2) **OR** ✓ reason ✓ answer (2)
1.4.2	$3(x-1)^2+5=3-k$ $3(x-1)^2=-k-2$ $3(x-1)^2=-(k+2)$ $\therefore k+2<0$ for all real values of x $k<-2$ **OR** $3x^2-6x+3+5=3-k$ $3x^2-6x+3+5+k-3=0$ $3x^2-6x+5+k=0$ $\Delta=(-6)^2-4(3)(5+k)$ $\Delta=36-60-12k$ $\Delta=-12k-24$ for real unequal roots $-12k-24>0$ $-12k>24$ $k<-2$ If AO $k \leq -2$ $\frac{3}{4}$ *marks*	✓✓ Method ✓✓ answer (4) **OR** ✓ sub ✓ $12k-24$ ✓Method ($\Delta>0$) ✓ answer Answer only full marks (4)
		[29]

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QUESTION 2

DAY	1	2	3	4	5
TIME	12	24	40	a	b

2.1.1

$a = 60$
$b = 84$

✓ $a = 60$
✓ $b = 84$
(2)

2.1.2

12 24 40 60 84
12 16 20 24
4 4 4

$2a = 4$
$a = 2$

$3(2) + b = 12$
$b = 6$

$2 + 6 + c = 12$
$c = 4$

$T_n = 2n^2 + 6n + 4$ do not subtract marks if not given

✓ second difference
can also be given at $2a = 4$

✓ a

✓ b

✓ c
(4)

2.1.3

$2n^2 + 6n + 4 = 312$ CA marking from 2.1.3
$2n^2 + 6n - 308 = 0$
$n^2 + 3n - 154 = 0$
$(n - 11)(n + 14) = 0$
$n = 11$ or $n \neq -14$

✓ $T_n = 312$
✓ standard form
✓ $n = 11$
✓ $n \neq -14$ (4)

2.2.1

$\sum_{k=1}^{\infty} 4p^{1-k} = 4 + \frac{4}{p} + \frac{4}{p^2} + \cdots$

$r = \frac{4}{p} \div 4$
$= \frac{1}{p}$

$S_\infty = \frac{4}{1 - \frac{1}{p}} = 3$
$4 = 3 - \frac{3}{p}$
$1 = -\frac{3}{p}$
$p = -3$

✓ First 3 terms

If only 2 terms, give the mark if r is correct in the next step

✓ $r = \frac{1}{p}$

✓ substitute into formula

Substitution must be in the correct formula.

✓ answer
(4)

2.2.2

$r = -\frac{1}{3}$
Series is convergent because $-1 < r < 1$
give full marks if learners only write $-1 < \frac{1}{3} < 1$

✓ r
✓ reason

CA marking only if $-1 < r < 1$
(2)

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2.3.1	$\frac{3x-4}{2}+9=\frac{-3x-10}{2}$ $3x-4+18=-3x-10$ $6x=-24$ $x=\frac{-24}{6}$ $x=-4$ answer is given **OR** $T_3=\frac{3x-4}{2}$ $a+2d=\frac{3x-4}{2}$ $a+2(3)=\frac{3x-4}{2}$ $a+6=\frac{3x-4}{2}$ ……(1) $T_6=\frac{-3x-10}{2}$ $a+5d=\frac{-3x-10}{2}$ $a+5(3)=\frac{-3x-10}{2}$ $a+15=\frac{-3x-10}{2}$ ……(2) $(2)-(1)$; $9=\frac{-3x-10}{2}-\frac{3x-4}{2}$ $18=-3x-10-3x+4$ $6x=-24$ $x=\frac{-24}{6}$ $x=-4$	✓ method ✓ Simplification (2) **OR** ✓ Method Getting to equation (1) and (2) ✓ Simplification For first step (2)
2.3.2	$T_3=\frac{3x-4}{2}$ $T_3=\frac{3(-4)-4}{2}$ $T_3=-8$ $d=3$ $T_1=T_3-3-3$ $T_1=-8-3-3$ $T_1=-14$ **OR**	✓ Subt. ✓ -8 ✓ -14 (3) **OR**

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	$T_3 = -8$ $a + 2d = -8$ $a + 2(3) = -8$ $a = -14$	✓ $a + 2d = -8$ ✓ Substitution ✓ -14 (3)
2.3.3	$S_{60} - S_{30}$ $= \frac{60}{2}[2(-14) + 59(3)] - \frac{30}{2}[2(-14) + 29(3)]$ $= 4470 - 885$ $= 3585$	✓ Method ✓ S_{60} subst. or 4470 ✓ S_{30} subs. or 885 ✓ answer (4)
		[25]

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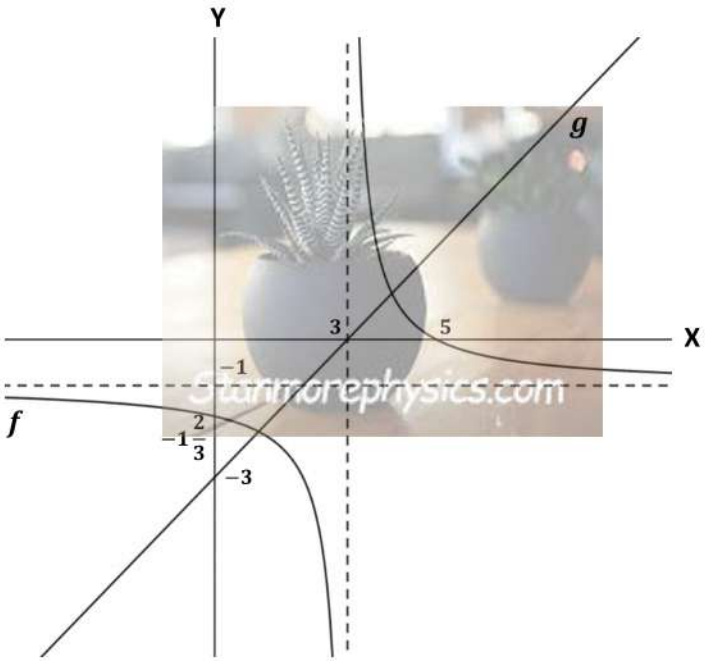
QUESTION 3

3.1	$x \in \mathbb{R}; x \neq 3$	✓ Answer (1)
3.2	$f(x) = \frac{2}{x-3} - 1$ $0 = \frac{2}{x-3} - 1$ $1 = \frac{2}{x-3}$ $x - 3 = 2$ $x = 5$	✓ $y = 0$ ✓ Answer (2)
3.3		Hyperbola: ✓ x-int & y-int ✓ asymptotes ✓ shape Line: ✓ x and y −int ✓ line (5)
3.4	$\frac{2}{x-3} - 1 = x - 3$ $\frac{2}{x-3} = x - 2$ $2 = x^2 - 5x + 6$ $x^2 - 5x + 4 = 0$ $(x-4)(x-1) = 0$ $x = 4$ or $x = 1$ $3 < x \leq 4$ $x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(4)}}{2(1)}$	✓ standard form ✓ factors / formula ✓ CV ✓ Inequality (4)
		[12]

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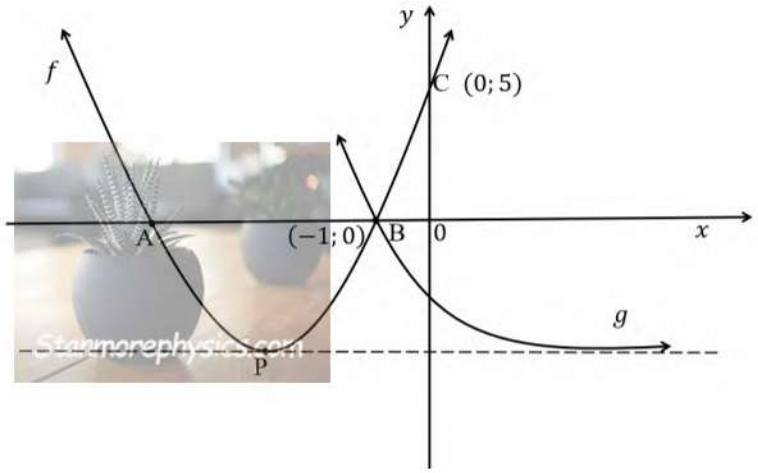
QUESTION 4



4.1	$x = -3$	✓ Answer (1)
4.2	$y = a(x+5)(x+1)$ $5 = a(5)(1)$ $a = 1$ $y = 1(x^2 + 6x + 5)$ $= x^2 + 6x + 5$	✓ substitute x-intercepts ✓ substitute $(0; 5)$ ✓ a ✓ equation (4)
4.3	$y = x^2 + 6x + 5$ CA from 4.2 $Subst. x = -3$: $y = (-3)^2 + 6(-3) + 5$ $y = 9 - 18 + 5$ $y = -4$ answer given	✓ substitute $x = -3$ (1)
4.4	$-3 < x < -1$ CA from 4.1	✓ CV ✓ Inequality (2)
4.5	g: $y = m^{-x} + k$ Subst. $(-1; 0)$ $0 = m^{-(-1)} - 4$ $m = 4$ $g(x) = 4^{-x} - 4$ $h(x) = 4^{-x}$ h^{-1}: $x = 4^{-y}$ $-y = \log_4 x$ $y = -\log_4 x$ OR $y = \log_{\frac{1}{4}} x$	✓ $m = 4$ ✓ equation of h ✓ swop x and y do not have to show this step ✓ $y = -\log_4 x$ or $y = \log_{\frac{1}{4}} x$ (4)
		[12]

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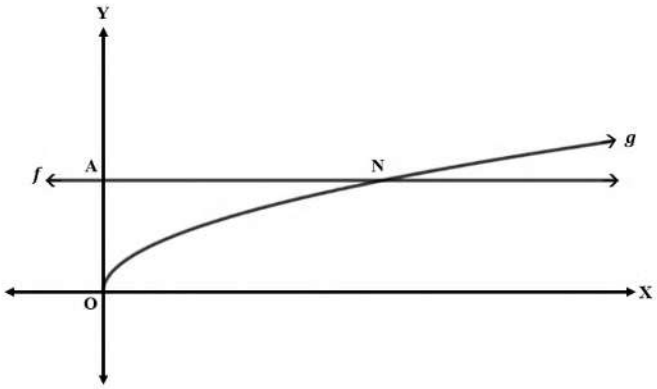
QUESTION 5



5.1	$y \geq 0$	✓ Answer (1)
5.2	$\sqrt{x} = 3$ $x = 9$ N(9; 3)	✓ $y = 3$ ✓ $x = 9$ (2)
5.3	$g(x) = \sqrt{x}$ g^{-1}: $y = \sqrt{x}$ where $y \geq 0$ $x = \sqrt{y}$ where $x \geq 0$ $y = x^2$ where $x \geq 0$	✓ swop x and y ✓ $y = x^2$ ✓ $x \geq 0$ (3)
		[6]

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QUESTION 6

6.1	$45\,000 = 20\,000\left(1+\frac{0{,}075}{12}\right)^{n}$ $\frac{9}{4} = \left(\frac{161}{160}\right)^{n}$ $n = \log_{\frac{161}{160}}\left(\frac{9}{4}\right)$ $= 130{,}15\ldots$ $= 131$ months or 10 years and 10 /11 months	✓ Correct sub into formula ✓ Correct use of logs ✓ Answer to the nearest month (3)
6.2.1	Original value of the equipment. Value at the start/ beginning	✓ Answer Accept other words if language barrier (1)
6.2.2	No, no matter how small the value, the next year it will be a fraction thereof. **OR** $E = P(1-i)^{n}$ No, E represents an exponential function with an asymptote at $E = 0$.	✓ Explanation (1) **OR** ✓ Explanation (1)
6.2.3	$48\,033 = 106\,239(1-i)^{4}$ $i = 1 - \sqrt[4]{\frac{48033}{106239}}$ $i = 0{,}1799\ldots$ $= 18\%$	✓ substitute into correct formula ✓ 4th root ✓ Answer Do not penalise for rounding (3)
6.3.1	$2\,464\,000 = \frac{x\left[1-\left(1+\frac{0{,}102}{12}\right)^{-360}\right]}{\frac{0{,}102}{12}}$ *or* 0,0085 $x = \text{R}21\,988{,}40$ **OR** $2\,464\,000\left(1+\frac{0{,}102}{12}\right)^{360} = \frac{x\left[\left(1+\frac{0{,}102}{12}\right)^{360}-1\right]}{\frac{0{,}102}{12}}$ $\frac{2\,464\,000\left(1+\frac{0{,}102}{12}\right)^{360}\left(\frac{0{,}102}{12}\right)}{\left[\left(1+\frac{0{,}102}{12}\right)^{360}-1\right]} = x$ $x = \text{R}21\,988{,}40$	✓ i ✓ n ✓ Substitute into PV ✓ Answer Do not penalise for rounding (4) **OR** ✓ i ✓ n ✓ Substitute into FV ✓ Answer (4)

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6.3.2	$\text{UB} = 2\,464\,000\left(1+\frac{0,102}{12}\right)^{84} - \frac{22\,500\left[\left(1+\frac{0,102}{12}\right)^{84}-1\right]}{\frac{0,102}{12}}$ $= \text{R}2\,274\,352,74$ **OR** $2\,464\,000 = \frac{22\,500\left[1-\left(1+\frac{0,102}{12}\right)^{-n}\right]}{\frac{0,102}{12}}$ $\frac{5236}{5625} = 1-\left(1+\frac{0,102}{12}\right)^{-n}$ $\left(\frac{2017}{2000}\right)^{-n} = \frac{389}{5625}$ $n = 315,6158005$ $\therefore$ 231,6158 months left. $UB = \frac{22\,500\left[1-\left(1+\frac{0,102}{12}\right)^{-231,6158}\right]}{\frac{0,102}{12}}$ $= \text{R}2\,274\,352,74$ **IF** $UB = \frac{22\,500\left[1-\left(1+\frac{0,102}{12}\right)^{-276}\right]}{\frac{0,102}{12}}$ $= R\,2\,391\,073,84$	✓ $2\,464\,000\left(1+\frac{0,102}{12}\right)^{84}$ ✓ $\frac{22\,500\left[\left(1+\frac{0,102}{12}\right)^{84}-1\right]}{\frac{0,102}{12}}$ ✓ answer (3) **OR** ✓ Sub into correct formula. ✓ Months left. ✓ answer (3) ONLY 1 mark for answer
		[15]

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QUESTION 7

7.1	$f(x) = -3x^2 + 7$ $f(x+h) = -3(x+h)^2 + 7$ $= -3x^2 - 6xh - 3h^2 + 7$ $f(x+h) - f(x) = -3x^2 - 6xh - 3h^2 + 7 + 3x^2 - 7$ $= -6xh - 3h^2$ $f'(x) = \lim_{h\to 0} \frac{-6xh - 3h^2}{h}$ $= \lim_{h\to 0} \frac{h(-6x + 3h)}{h}$ $= \lim_{h\to 0}(-6x + 3h)$ $= -6x$	✓ $f(x+h)$ ✓ $f(x+h) - f(x)$ ✓ substitute in formula ✓ common factor/simplify ✓ answer Answer only – no marks. -1 for notation (5)
7.2.1	$y = 8\sqrt{x} - \sqrt{21}$ $= 8x^{\frac{1}{2}} - \sqrt{21}$ $\frac{dy}{dx} = 4x^{-\frac{1}{2}}$	✓ $8x^{\frac{1}{2}}$ ✓ $4x^{-\frac{1}{2}}$ ✓ 0 [CA only if exponent is a fraction] (3)
7.2.2	$x^2y = 2x^3 + 4$ $y = 2x + 4x^{-2}$ $\frac{dy}{dx} = 2 - 8x^{-3}$	✓ $2x$ ✓ $4x^{-2}$ ✓ 2 ✓ $-8x^{-3}$ (4)
7.3	$y = hx + x^3$ $\frac{dy}{dx} = h + 3x^2$ $h + 3(-1)^2 = 0$ $h = -3$	✓ Derivative ✓ $h + 3(-1)^2 = 0$ ✓ answer (3)
		[15]

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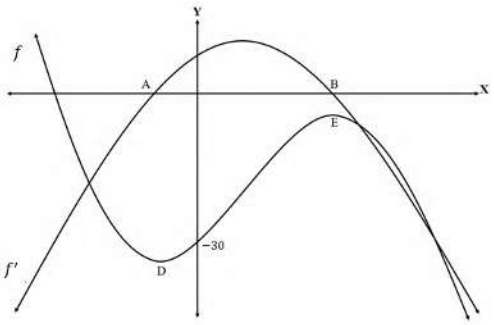
QUESTION 8



8.1	$-3x^2 + 6x + 9 = 0$ $x^2 - 2x - 3 = 0$ $(x-3)(x+1) = 0$ $x = 3$ or $x = -1$ D: $x = -1$ and E: $x = 3$ $x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(3)}}{2(1)}$	✓ $f'(x) = 0$ ✓ Factors or formula ✓ Answers (3)
8.2	$f(x) = ax^3 + bx^2 + cx + d$ $f'(x) = 3ax^2 + 2bx + c$ $3a = -3$ $a = -1$ $2b = 6$ $b = 3$ $c = 9$ $f(x) = -x^3 + 3x^2 + 9x - \mathbf{30}$	✓ Derivative ✓ $a = -1$ ✓ $b = 3$ ✓ $c = 9$ ✓ equation (5)
8.3	$-1 \leq x \leq 3$ accept if you taught this OR $-1 < x < 3$ according to me this is the correct answer	✓ CV ✓ Inequality (2)
8.4	Concave down: $f''(x) < 0$ $-6x + 6 < 0$ $-6x < -6$ $\therefore x > 1$ **OR** $x = \frac{-1+3}{2}$ $x = 1$ $\therefore x > 1$ **OR** $x = \frac{-(3)}{3(-1)}$ $x = -\frac{b}{3a}$ $x = 1$ $\therefore x > 1$	✓ method ✓ $x = 1$ ✓ answer (3) **OR** ✓ method ✓ $x = 1$ ✓ answer (3) **OR** ✓ method ✓ $x = 1$ ✓ answer (3) Answer only full marks
		[13]

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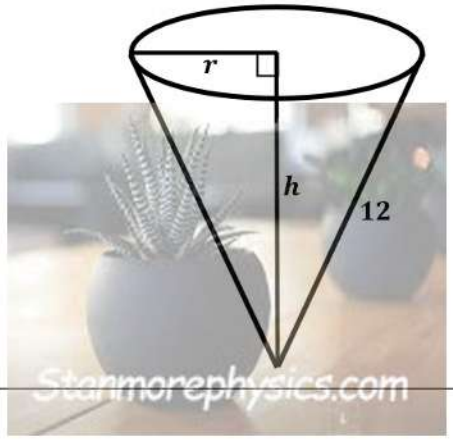
QUESTION 9



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9.1	$V = \frac{1}{3}\pi r^2 h$ $h^2 + r^2 = 144$ $r^2 = 144 - h^2$ $V = \frac{1}{3}\pi h(144 - h^2)$ $= 48\pi h - \frac{1}{3}\pi h^3$ answer given	✓ formula ✓ r^2 in terms of h ✓ substitute in volume formula (3)
9.2	$\frac{dV}{dh} = 48\pi - \pi h^2$ $48\pi - \pi h^2 = 0$ $h^2 = 48$ $h = 4\sqrt{3}$ *or* 6,93	✓ derivative ✓ $= 0$ ✓ answer Do not penalise for rounding (3)
		[6]

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QUESTION 10

10.1.1	(a) 90 ; (b) 120	✓ a ; ✓b (2)
10.1.2	$\text{P(Male and like B)} = \frac{60}{250} = 0,24$	✓ answer in any form (1)
10.1.3	$\text{P(Male and like B)} = \frac{60}{250} = 0,24$ $\text{P}(Like\ B) = \frac{130}{250} = 0,52$ $P(Male) = \frac{150}{250} = 0,6$ $P(Like\ B) \times P(Male) = 0,52 \times 0,6$ $= 0,312$ $\neq P(Male\ \ and\ like\ B)$ ∴Not independent **OR** $P(Male) = \frac{150}{250} = 0,6$ $P(do\ not\ like\ B) = \frac{120}{250} = 0,48$ $P(Male)\ \times\ P(do\ not\ like\ B)\ = (\frac{150}{250})(\frac{120}{250})$ $= 0,288$ $P(M\ and\ do\ not\ like\ B)\ = \frac{90}{250} = 0,36$ P(M) × P(do not like B) ≠ P(M and do not like B) ∴ Not independent **OR** $\text{P(Female and like B)} = \frac{70}{250} = 0,28$ $\text{P}(Like\ B) = \frac{130}{250} = 0,52$ $P(Female) = \frac{100}{250} = 0,4$ $P(Like\ B) \times P(Female) = 0,52 \times 0,4$ $= 0,208$ $\neq P(Feale\ \ and\ like\ B)$ ∴Not independent	✓ $\text{P}(Like\ B)$ ✓ $P(Male)$ ✓ $P(Like\ B) \times P(M) = 0,312$ ✓ Conclusion (4) **OR** ✓ Both P(M) a & P(do not like B) ✓ Product ✓ $P(M\ and\ do\ not\ like\ B)$ ✓ Conclusion (4) **OR** ✓ $\text{P}(Like\ B)$ ✓ $P(Female)$ ✓ $P(Like\ B) \times P(M) = 0,208$ ✓ Conclusion (4)

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10.2.1	$8! = 40\,320$	✓ *answer* Accept if only write 8! (1)
10.2.2	$\frac{1}{8} \times \frac{1}{7} \times \frac{1}{6}$ *or* $0{,}125 \times 0{,}142857 \times 0{,}166666$ $= \frac{1}{336}$ *or* $0{,}002976$ **OR** $\frac{5 \times 4 \times 3 \times 2 \times 1}{8!}$ *or* $\frac{120}{40320}$ $= \frac{1}{336}$	✓ $\frac{1}{8}$ ✓ $\frac{1}{7} \times \frac{1}{6}$ ✓ *answer* −1 if not multiplying (3) **OR** ✓ 5! ✓ Divide 8! ✓ Answer (3)
10.3.1	$5 \times 5 \times 9 \times 9$ $= 2025$	✓ 5×5 ✓ 9×9 Answer only full marks (2)
10.3.2	• 2 letters and 4 digits (2 letters en 4 syfers) $5{\times}5{\times}9{\times}9{\times}8{\times}7{=}113\,400$ • 2 letters and 5 digits (2 letters en 5 syfers) $5 \times 5 \times 9 \times 9 \times 8 \times 7 \times 6 = 680\,400$ They would require 5 digits. *Hul benodig 5 syfers*	✓ Method ✓ Method ✓ ✓ Answer (4)
		[17]

TOTAL: 150