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basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1

NOVEMBER 2025

MARKS: 150

TIME: 3 hours

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This question paper consists of 11 pages, 1 information sheet and an answer book of 23 pages.

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INSTRUCTIONS AND INFORMATION

Read the following instructions and information carefully before answering the questions.

1. This question paper consists of 11 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs, etc. that you have used in determining your answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. An information sheet with formulae is included at the end of the question paper.
9. Write neatly and legibly.

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QUESTION 1.

1.1 Solve for x:

1.1.1 $(x+5)(x-2)=0$ (2)

1.1.2 $5x^2+2=-9x$ (correct to TWO decimal places) (4)

1.1.3 $8x^2>2x$ (4)

1.1.4 $2.2^{2x}-9.2^x+4=0$ (4)

1.1.5 $\sqrt{\sqrt{\frac{1}{x}}+2}=\frac{1}{\sqrt{x}}$ (5)

1.2 Calculate the values of x and y if:

- x is the sum of 2 and y
- Five times the product of x and y, is 6 more than the square of x (6)

[25]

QUESTION 2

2.1 Given the infinite geometric series: $(t+10)+(t-2)+(t+4)+\ldots$

2.1.1 Show that $t=-2$ (3)

2.1.2 Calculate the value of T_{25}. Write your answer in the form $T_n=b^x$ (3)

2.1.3 Calculate the sum of the infinite series. (2)

2.2 Given $\sum_{p=k}^{117}(4p-1)=26\,675$

2.2.1 Write down the difference between T_6 and T_{14} (2)

2.2.2 Calculate the value of k. (5)

[15]

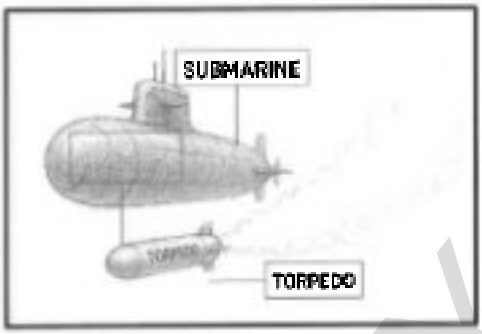
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QUESTION 3

The depth of a torpedo below sea level forms a quadratic pattern, where 0 metres is at sea level. A submarine tracked a torpedo in one-second intervals.



The depth (in metres) that the torpedo reached is given in the table below.

	Depth (in metres)
At the end of the first second	36
At the end of the first 2 seconds	71
At the end of the first 3 seconds	104

3.1 Calculate the depth of the torpedo at the end of the first 5 seconds. (2)

3.2 Show that the depth of the torpedo at the end of n seconds was $T_n = -n^2 + 38n - 1$ (3)

3.3 Calculate the maximum depth that the torpedo reached. (3)

3.4 After how many seconds was the torpedo at 104 m below sea level for the second time? (2)
[10]

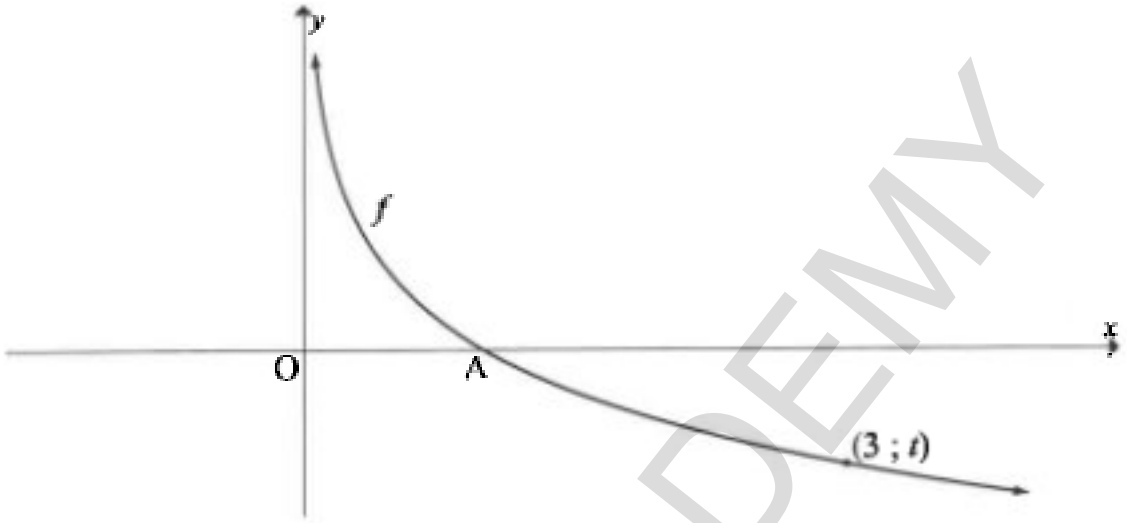
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QUESTION 4

The graph of $f(x) = \log_{\frac{1}{3}} x$ is drawn below. Point A is the x-intercept of f and $(3 ; t)$ lies on f.



4.1 Calculate the value of t (1)

4.2 Write down the coordinates of A. (1)

4.3 Determine the equation of f^{-1}, the inverse of f, in the form $y = \ldots$ (2)

4.4 Write down the equation of the asymptote of f^{-1} (1)

4.5 Draw the graph of f^{-1} on the set of axes provided in the ANSWER BOOK. Clearly indicate the intercepts with the axes, the coordinates of ONE other point and the asymptotes. (3)

4.6 The graph of h is obtained when f^{-1} is translated 5 units to the right. Determine the y-values of h where $x > 4$. (2)
[10]

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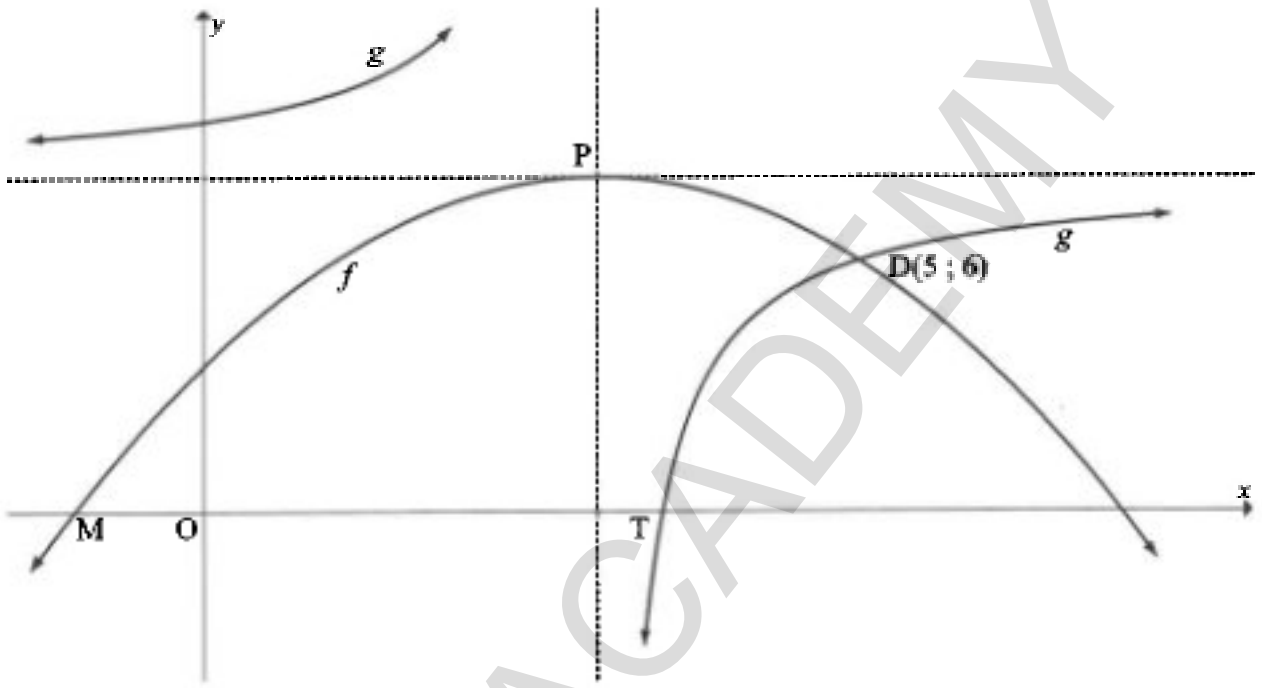
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QUESTION 5

The graphs of $f(x)=ax^2+bx+c$ and $g(x)=\frac{-4}{x-3}+8$ are drawn below.

P is the turning point of f and the point of intersection of the asymptotes of g.
The graphs intersect at D(5 ; 6). M and T are x-intercepts of f and g respectively.



5.1 Write down the domain of g. (1)

5.2 Write down the range of f. (1)

5.3 Determine the values of x for which:

5.3.1 $g(x) \leq f(x)$ (2)

5.3.2 $f(x) < 6$ (2)

5.4 Show that the equation of the parabola is $f(x)=-\frac{1}{2}x^2+3x+\frac{7}{2}$ (3)

5.5 Calculate the length of MT. (6)

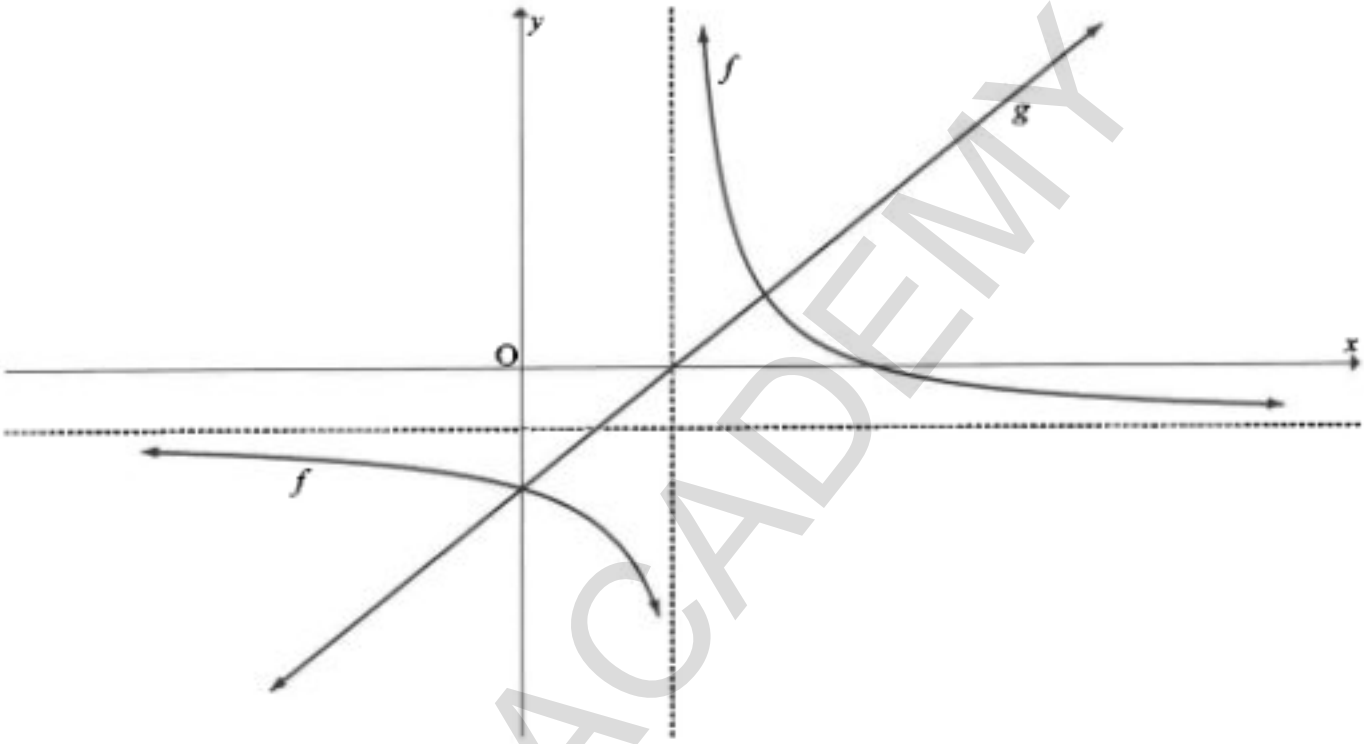
5.6 Determine the equation of the tangent to f at D. (3)
[18]

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QUESTION 6

The graphs of $g(x) = x + c$ and $f(x) = \frac{a}{x+p} + q$ are drawn below. Graph g and the vertical asymptote of f intersect at the x-axis.



6.1 Write down the coordinates of the x-intercept of g in terms of p. (1)

6.2 Graph g intersects the horizontal asymptote of graph f at $x = 1$ and the graph f at $x = 3$. Graphs f and g also intersect on the y-axis. Determine the equation of f. (5)

6.3 Describe the transformation that g must undergo to become an axis of symmetry of f that cuts f at two points. (2)
[8]

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QUESTION 7

7.1 A travel company informs Robert that a holiday to a certain destination costs R40 000 now. The company predicts that the cost of this holiday will increase by 7,8% per annum. What will this holiday cost in 5 years' time? (2)

7.2 Sarah opened a savings account that paid interest at a rate of 5,8% p.a., compounded quarterly. She deposited R2 300 into the account on 1 January 2020 and continued to make deposits of R2 300 at the beginning of each quarter thereafter. She made her last deposit on 1 October 2025. Calculate the accumulated amount in the account on 1 January 2026. (4)

7.3 The bank granted Rajesh a loan of R900 000 on 28 February 2024 at an interest rate of 6,8% p.a., compounded monthly.

7.3.1 Rajesh was unable to make the first three payments. He made his first repayment of R10 000 on 30 June 2024. He continued to make monthly repayments of R10 000 at the end of each month thereafter. How long, in completed months, will it take Rajesh to repay the loan from the time the loan was granted? (5)

7.3.2 Calculate the value of the final payment. (4)
[15]

QUESTION 8

8.1 Determine $f'(x)$ from first principles if it is given that $f(x) = -2x + 3$. (4)

8.2 Determine:

8.2.1 $g'(x)$ if $g(x) = -3x^4 + 2x$ (2)

8.2.2 $\frac{dy}{dx}$ if $y = \frac{2x^4 + 1}{x^3}$ (4)
[10]

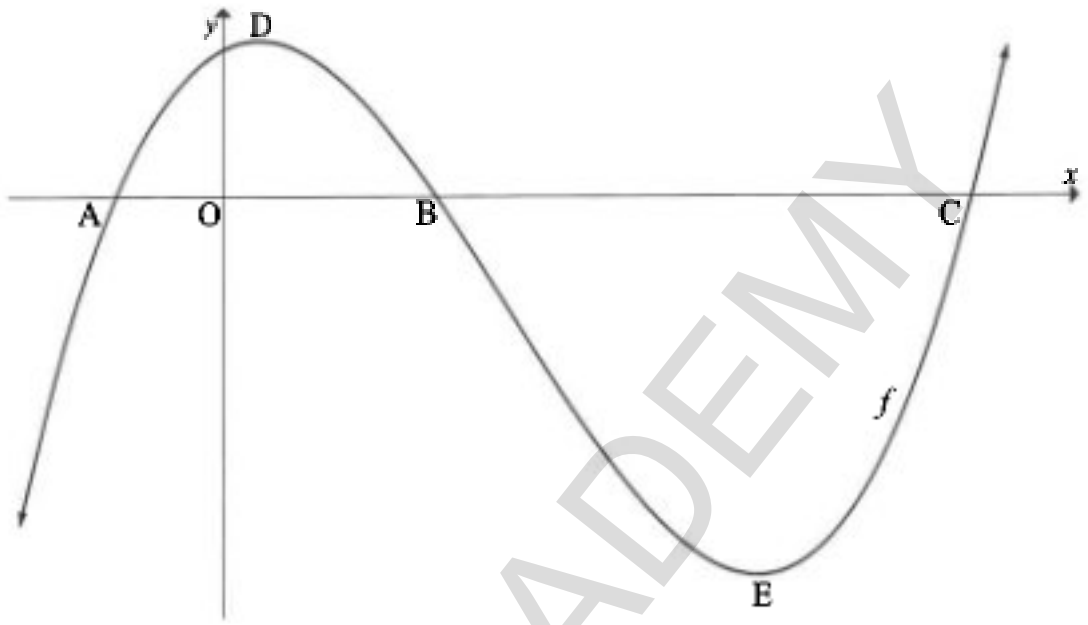
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QUESTION 9

Sketched below is the graph of $f(x)=x^3-8x^2+5x+14$. A, B and C are the x-intercepts of f. D and E are the turning points of f.



9.1 Calculate the coordinates of E. (4)

9.2 For which values of x is f concave down? (3)

9.3 The coordinates of B are $(2;0)$. Use the graph to determine the values of x for which $f(x).f''(x)<0$ (4)

9.4 For which values of t will $y=-11x+t$ intersect f at 3 distinct points? (6)
[17]

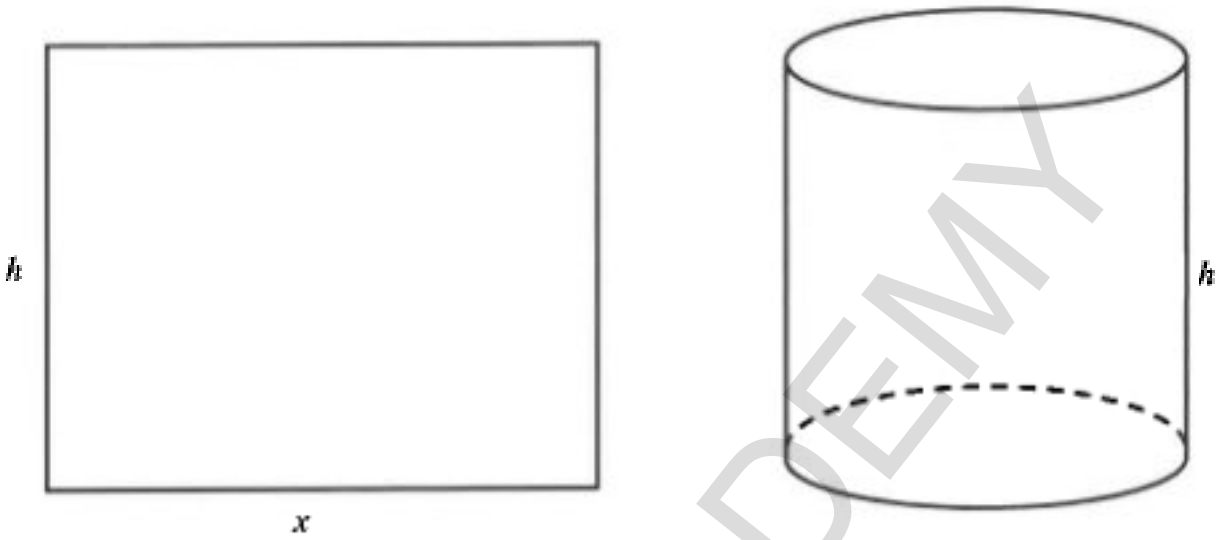
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QUESTION 10

A rectangular metal sheet has dimensions x and h units, with $x > h$, and a perimeter of 50 units. The metal sheet is rolled into a cylinder with two open ends (top and bottom) and height h units.



10.1 Show that the volume of the cylinder is given by $V = \frac{25x^2}{4\pi} - \frac{x^3}{4\pi}$ (3)

10.2 Calculate the value of x that will maximise the volume of the cylinder. (3)
[6]

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QUESTION 11

11.1 A survey was conducted among female and male learners at a school about which type of cold drink they preferred. The data from the survey is presented in the table below.

	JUICE	ENERGY DRINKS	TOTAL
Female	*a*	*b*	*c*
Male	36	54	*f*
Total	*e*	*d*	210

11.1.1 The events male and preferring juice are independent. Show that $e = 84$. (3)

11.1.2 Calculate the probability that a female learner, chosen at random from the group, will like energy drinks. (3)

11.2 At a kiosk, 120 people buy either a cup of coffee or a bottle of water. The chance of rain on any given day is 75%. The chance of a person buying a cup of coffee on a rainy day is three times the chance of the person buying coffee on a non-rainy day.

The probability of a person buying coffee on any given day is $\frac{7}{12}$.

Calculate the number of cups of coffee that will be sold on a non-rainy day. (4)

11.3 Eight runners compete in a race where there are no tied finishes. Bongi and Andrew are two of the competitors.

11.3.1 Calculate the total number of possible ways in which the 8 runners can finish the race if Bongi finishes in a position immediately after Andrew. (2)

11.3.2 Calculate the probability that TWO OR MORE runners finish the race after Andrew and before Bongi. (4)

[16]

TOTAL: 150

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INFORMATION SHEET

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$\sin 2\alpha = 2\sin\alpha.\cos\alpha$

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

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

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

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