



KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL STANDARDISED ASSESSMENT

GRADE 12

MATHEMATICS P1
PREPARATORY EXAMINATION
SEPTEMBER 2026

MARKS: 150

TIME: 3 hours

This question paper consists of 11 pages and an information sheet.

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 in the ANSWER BOOK provided.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Clearly show ALL calculations, diagrams, graphs, etc. which 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. Diagrams are NOT necessarily drawn to scale.
8. If necessary, round off answers correct to TWO decimal places, unless stated otherwise.
9. Write neatly and legibly.



QUESTION 11.1 Solve for x :

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

$$1.1.2 \quad x^2 - 5 = -8x \text{ (correct to TWO decimal places).} \quad (4)$$

$$1.1.3 \quad 3x^2 - 16x \leq -5 \quad (4)$$

$$1.1.4 \quad (\sqrt{x-1}-3)(\sqrt{x-1}+2) = -6 \quad (5)$$

1.2 Solve simultaneously for x and y :

$$\begin{aligned} x - 2y &= 3 \\ 3x^2 - 5xy &= 24 + 16y \end{aligned} \quad (5)$$

1.3 Given: $(\sqrt{7})^x + (\sqrt[3]{5})^y = 54$; where x and $y \in \mathbb{N}$. Determine the value of P , where $P = x \times y$. (4)

[25]

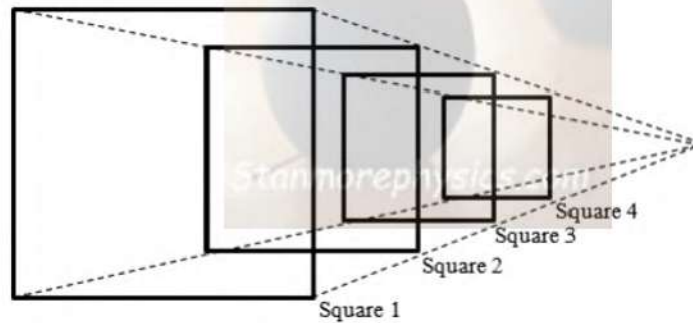
QUESTION 2

- 2.1 The fourth term of an arithmetic sequence is 15 and the twelfth term is 47.
Determine the first two terms of the sequence. (4)

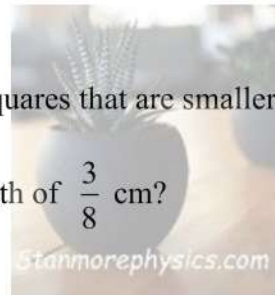
- 2.2 The areas of the first three squares in the sketch below are as follows:

- Area of Square 1: 18 cm^2
- Area of Square 2: 9 cm^2
- Area of Square 3: $\frac{9}{2} \text{ cm}^2$

The pattern continues indefinitely.



- 2.2.1 Write down the area of Square 4. (1)
- 2.2.2 Calculate the total area of all the squares that are smaller than Square 6. (6)
- 2.2.3 Which square will have a side length of $\frac{3}{8} \text{ cm}$? (5)



[16]

QUESTION 3

3.1 Calculate: $\sum_{k=10}^{25} (7 - 5k)$. (4)

3.2 The following information of a quadratic pattern is given:

- $T_n = an^2 + bn + 6$
- $T_4 = 26$
- $T_3 - T_2 = 7$

Determine the values of a and b . (4)

[8]

QUESTION 4

Given: $f(x) = \frac{-9}{x-3} + 2$

4.1 Write down the equations of the asymptotes of f . (2)

4.2 Calculate the

4.2.1 x -intercept of f . (2)

4.2.2 y -intercept of f . (1)

4.3 Sketch the graph of f , showing all the intercepts with the axes and the asymptotes. (3)

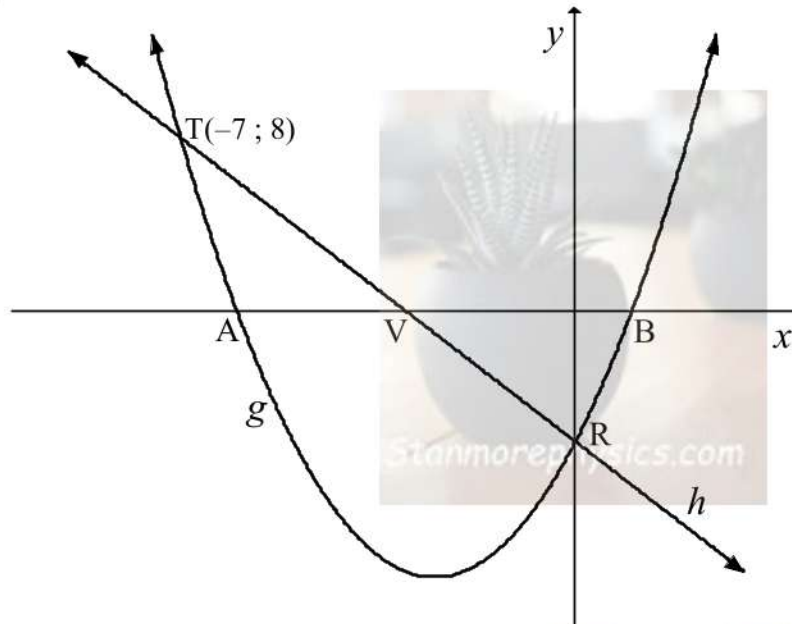
4.4 Describe in words the single transformation of f to g , where $g(x) = \frac{9}{x+3} + 2$. (2)

4.5 For which values of p will $f(x) + p = 0$ have one negative root? (2)

[12]

QUESTION 5

The diagram below shows the graphs of $g(x) = x^2 + 5x - 6$ and $h(x) = mx + c$. A and B are the x -intercepts of g , and V is the x -intercept of h . g and h intersect on the y -axis at R and also at $T(-7; 8)$.

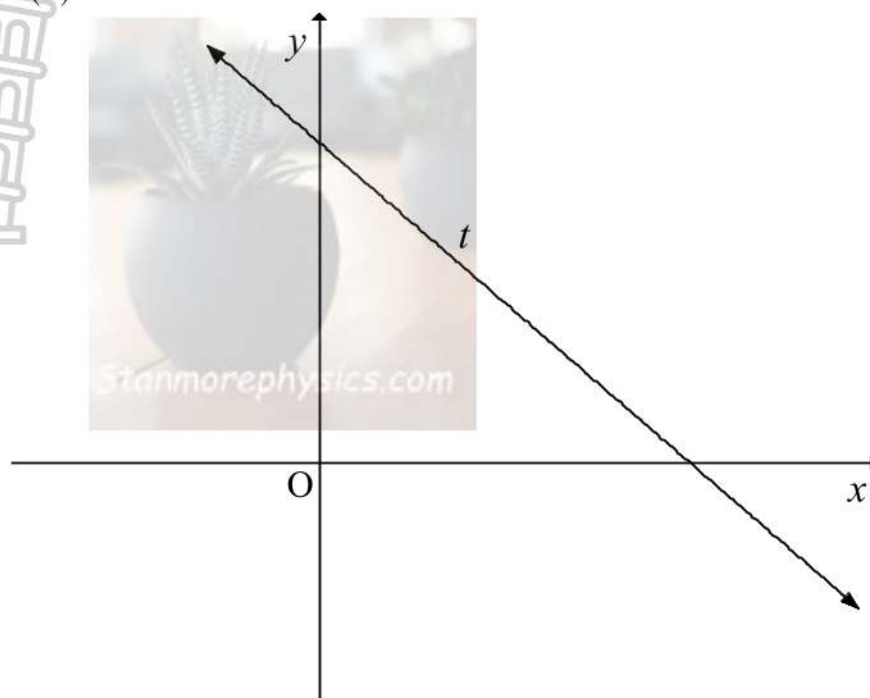


- 5.1 Write down the coordinates of R. (1)
- 5.2 Determine the equation of h . (3)
- 5.3 Write the equation of g in the form $y = a(x + p)^2 + q$. (2)
- 5.4 Determine the coordinates of a point W on g , such that the average gradient between T and W will be -4 . (5)
- 5.5 It is given that the coordinates of A and B are $(-6; 0)$ and $(1; 0)$ respectively.
Determine the values of x for which $\frac{g(x)}{h(x)} \leq 0$. (4)

[15]

QUESTION 6

The graph of $t(x) = -x + 4$ is drawn below.



- 6.1 Draw on the same set of axes the graph of $s(x) = \log_3 x$, showing any intersections with the axes. (2)
- 6.2 Write down the equation of $s^{-1}(x)$, in the form $y = \dots\dots\dots$ (2)
- 6.3 Explain how you will use question 6.1 and/or question 6.2 to solve $\log_3(4-x) = x$. (3)
- 6.4 Write down the solution to $\log_3(4-x) = x$. (1)

[8]

QUESTION 7

- 7.1 Rajesh inherited a sum of money from his father. He invested the money at 7,3% p.a., compounded quarterly. After how many years will his inheritance have doubled? Give your answer correct to 1 decimal place. (4)
- 7.2 On 30 June 2013, and at the end of each month thereafter, Jacob deposited R2 500 into a bank account that paid 8% p.a., compounded monthly. He continued making these deposits until 31 May 2018. How much money was in his account immediately after making the last deposit on 31 May 2018? (4)
- 7.3 On 31 January 2026, Thandokuhle took out a loan of R82 000 from the bank to pay for her studies. The bank charges interest of 12% per year, compounded monthly. Her monthly instalment to pay back the loan is R3 200. She paid her first instalment on 28 February 2026.
- 7.3.1 How many instalments will she have to pay in order to settle the loan? (4)
- 7.3.2 Calculate her final instalment. (3)

[15]**QUESTION 8**

- 8.1 Determine $f'(x)$ from first principles if $f(x) = x - 3x^2$. (5)
- 8.2 Determine the following:
- $$D_x \left(\frac{4x^2 + x + 2\sqrt{x}}{2x^2} \right)$$
- (4)
- 8.3 Given: $p(x) = 5x^3 + x$.
Explain, using relevant calculations, why it is not possible for a tangent drawn to the graph of p to have a negative gradient. (3)

[12]

QUESTION 9

9.1 Given: $f(x) = -x(x-3)^2$ with $f'(1) = f'(3) = 0$ and $f(1) = -4$

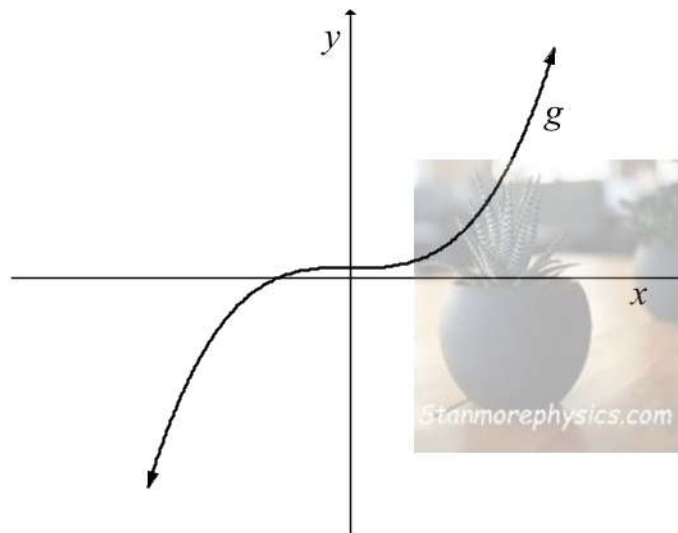
9.1.1 Draw a sketch graph of f , clearly indicating the intercepts with the axes and the turning points. (4)

9.1.2 Determine the coordinates for the local maximum of h if $h(x) = -f(x-2)$. (2)

9.1.3 Calculate $f''(x)$. (3)

9.1.4 Hence, determine whether the graph of f is concave up or concave down at $(0; 0)$. Show all your calculations. (3)

9.2 Sketched below is the graph of $g(x) = x^3 + 1$.

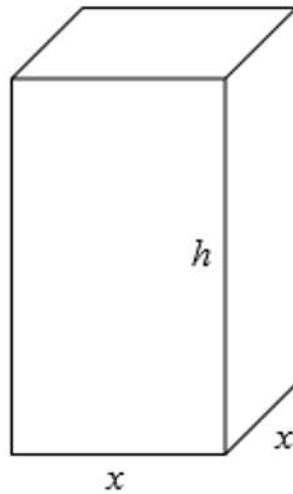


For which values of k will $y = 12x + k$ intersect g at 3 distinct points? (5)

[17]

QUESTION 10

A piece of cardboard with area $1\,350\text{ cm}^2$ is folded to form a closed rectangular box with a square base. The side length of the square base is $x\text{ cm}$ and the height of the box is $h\text{ cm}$.



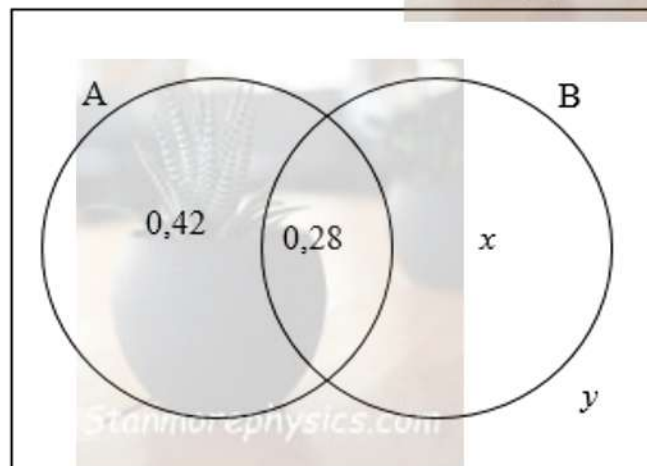
10.1 Show that the volume of the box is given by: $V(x) = \frac{675x}{2} - \frac{x^3}{2}$ (4)

10.2 Determine the value of x for which the volume of the box will be a maximum. (3)

[7]

QUESTION 11

11.1 A and B are two events. The probabilities of these events, (or a combination of them) occurring, are given in the Venn-diagram below. A and B are independent events.



Calculate:

11.1.1 the value of x . (3)

11.1.2 the value of y . (1)

11.1.3 $P(A \text{ or } B)$ (1)

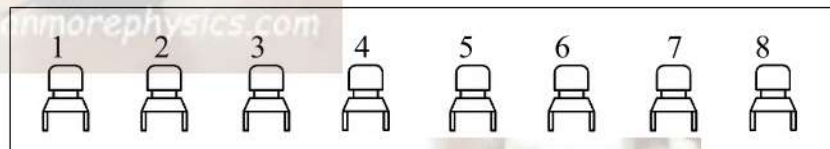
- 11.2 The probability that it will rain tomorrow is 70%.
If it rains, the probability that Nomsa will arrive late at the office is 25%.
If it does not rain, the probability that Nomsa will arrive late at the office is 10%.
Calculate the probability that Nomsa will be on time for work tomorrow. (4)

- 11.3 A modelling agency invited eight grade 12 learners for a photo shoot. There were 4 girls and 4 boys.
The names of the girls were Zanele, Sandra, Anashya and Nonhlanhla.
The names of the boys were Thulani, Ruan, Reggie and Peter.

- 11.3.1 For the first photo, the learners had to stand in a line in any order they preferred. In how many ways could they arrange themselves for this photo? (1)

- 11.3.2 For the second photo, four chairs were placed in a row, and the learners were told that any four of them could pose for this photo. How many arrangements were possible for this photo? (1)

- 11.3.3 For the third photo, eight chairs were placed in a row, as shown in the sketch below:



Peter and Nonhlanhla were told to sit in the middle, on chairs no. 4 and 5, in any order.

The other six learners could sit on any of the remaining chairs.

What is the probability that all three the other girls will sit on the one side, and all three the other boys on the other side? (4)

[15]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$y = mx + c$$

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

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

$$m = \tan \theta$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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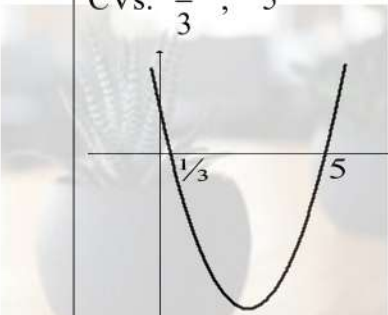
PREPARATORY EXAMINATION

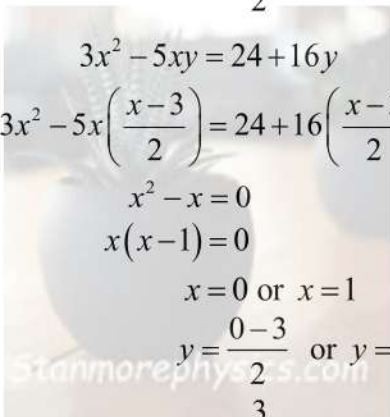
MARKING GUIDELINES

MARKS: 150

These marking guidelines consist of 16 pages.

QUESTION 1

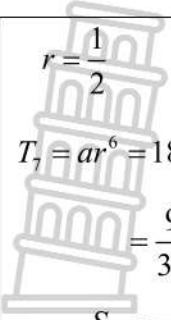
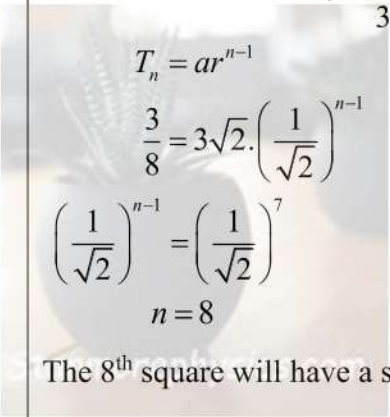
1.1.1	$2x - 4x^2 = 0$ $2x(1 - 2x) = 0$ $x = 0$ or $x = \frac{1}{2}$	✓ A common factor ✓ CA ✓ CA answers (3)
1.1.2	$x^2 - 5 = -8x$ $x^2 + 8x - 5 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(8) \pm \sqrt{(8)^2 - 4(1)(-5)}}{2(1)}$ $x = -8,58$ or $x = 0,58$ Penalise for incorrect rounding: 1 mark; only in this question.	✓ A standard form ✓ CA substitution ✓ CA ✓ CA answers (4)
1.1.3	$3x^2 - 16x \leq -5$ $3x^2 - 16x + 5 \leq 0$ $(3x - 1)(x - 5) \leq 0$ CVs: $\frac{1}{3}$; 5  $\frac{1}{3} \leq x \leq 5$ OR $x \in \left[\frac{1}{3}; 5\right]$	✓ A $3x^2 - 16x + 5 \leq 0$ ✓ CA critical values ✓ ✓ CA CA answer (4)
1.1.4	$(\sqrt{x-1}-3)(\sqrt{x-1}+2) = -6$ $x-1-\sqrt{x-1}-6 = -6$ $\sqrt{x-1} = x-1$ $(\sqrt{x-1})^2 = (x-1)^2$ $x-1 = x^2-2x+1$ $x^2-3x+2 = 0$ $(x-1)(x-2) = 0$ $x = 1$ or $x = 2$ OR	✓ A LHS of equation ✓ CA isolating the surd ✓ CA squaring both sides ✓ CA standard form ✓ CA both answers (5)

	 Let $k = \sqrt{x-1}$: $\therefore (k-3)(k+2) = -6$ $k^2 - k - 6 = -6$ $k^2 - k = 0$ $k(k-1) = 0$ $k = 0 \quad \text{or} \quad k = 1$ $\sqrt{x-1} = 1 \quad \text{or} \quad \sqrt{x-1} = 0$ $x-1 = 1 \quad \quad \quad x-1 = 0$ $x = 2 \quad \quad \quad x = 1$	✓A $k^2 - k - 6 = -6$ ✓CA factorisation ✓CA values of k ✓CA squaring both sides ✓CA both answers (5)
1.2	$x - 2y = 3$ $x = 3 + 2y$ $3y^2 - 5xy = 24 + 16y$ $3(3+2y)^2 - 5y(3+2y) = 24 + 16y$ $2y^2 + 5y + 3 = 0$ $(2y+3)(y+1) = 0$ $y = -\frac{3}{2} \quad \text{or} \quad y = -1$ $x = 3 + 2\left(-\frac{3}{2}\right) \quad \text{or} \quad x = 3 + 2(-1)$ $x = 0 \quad \quad \quad \text{or} \quad x = 1$ OR $y = \frac{x-3}{2}$  $3x^2 - 5xy = 24 + 16y$ $3x^2 - 5x\left(\frac{x-3}{2}\right) = 24 + 16\left(\frac{x-3}{2}\right)$ $x^2 - x = 0$ $x(x-1) = 0$ $x = 0 \quad \text{or} \quad x = 1$ $y = \frac{0-3}{2} \quad \text{or} \quad y = \frac{1-3}{2}$ $y = -\frac{3}{2} \quad \text{or} \quad y = -1$	✓A making x subject of the formula ✓CA substitution ✓CA standard form ✓CA y-values ✓CA x-values (5) OR ✓A making y the subject of the formula ✓CA substitution ✓CA standard form ✓CA x-values ✓CA y-values (5)

1.3	$7^{\frac{x}{2}} + 5^{\frac{y}{3}} = 7^2 + 5^1$ $\frac{x}{2} = 2 \quad \text{and} \quad \frac{y}{3} = 1$ $x = 4 \quad \text{and} \quad y = 3$ $\therefore P = 4 \times 3$ $P = 12$	✓ A $7^{\frac{x}{2}} + 5^{\frac{y}{3}} = 7^2 + 5^1$ ✓ A equating exponents with the same base ✓ A value of x and value of y ✓ A value of P (4)
		[25]

QUESTION 2

2.1.	$a + 3d = 15 \dots (1)$ $a + 11d = 47 \dots (2)$ Subtract (1) from (2): $8d = 32$ $d = 4$ $a + 3(4) = 15$ $a = 3$ $3; 7; \dots$	✓ A both equations ✓ CA solving simultaneously ✓ CA value of d ✓ CA answer (4)
2.2.1	$\frac{9}{4}$	✓ A answer (1)
2.2.2	$r = \frac{1}{2}$ $S_{\infty} = \frac{a}{1-r}$ $= \frac{18}{1 - \frac{1}{2}}$ $= 36$ $S_6 = \frac{a(r^n - 1)}{r - 1}$ $= \frac{18 \left[\left(\frac{1}{2} \right)^6 - 1 \right]}{\frac{1}{2} - 1}$ $= 35,44$ $\therefore$ Total area of squares smaller than Square 6 $= 36 - 35,44 = 0,56 \text{ cm}^2$ OR	✓ A value of r ✓ CA substitution in S_{∞} ✓ CA value of S_{∞} ✓ CA substitution in S_6 ✓ CA value of S_6 ✓ CA answer (6)

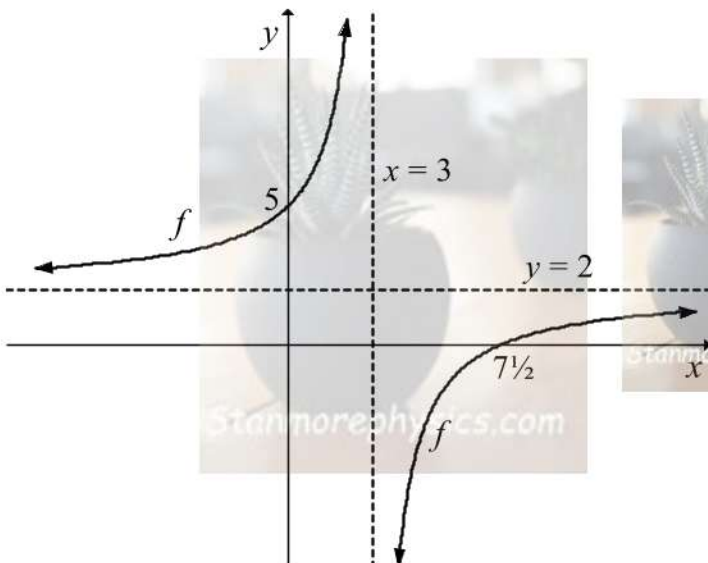
332	 $r = \frac{1}{2}$ $T_7 = ar^6 = 18\left(\frac{1}{2}\right)^6$ $= \frac{9}{32}$ $S_\infty = \frac{a}{1-r}$ $= \frac{\frac{9}{32}}{1-\frac{1}{2}}$ $= \frac{9}{16} = 0,56$	✓ A value of r ✓ CA substitution in T_7 ✓ CA value of T_7 ✓ CA substitution of a in S_∞ ✓ CA substitution of r in S_∞ ✓ CA answer (6)
2.2.3	side length of Square 1 = $\sqrt{18} = 3\sqrt{2}$ side length of Square 2 = $\sqrt{9} = 3$ $r = \frac{3}{3\sqrt{2}} = \frac{1}{\sqrt{2}}$  $T_n = ar^{n-1}$ $\frac{3}{8} = 3\sqrt{2} \cdot \left(\frac{1}{\sqrt{2}}\right)^{n-1}$ $\left(\frac{1}{\sqrt{2}}\right)^{n-1} = \left(\frac{1}{\sqrt{2}}\right)^7$ $n = 8$ The 8th square will have a side length of $\frac{3}{8}$ cm. OR Area of square = $\left(\frac{3}{8}\right)^2 = \frac{9}{64}$ $a = 18; \quad r = \frac{1}{2}$ $T_n = ar^{n-1}$ $\frac{9}{64} = 18\left(\frac{1}{2}\right)^{n-1}$ $\left(\frac{1}{2}\right)^7 = \left(\frac{1}{2}\right)^{n-1}$ $n = 8$ The 8th square will have a side length of $\frac{3}{8}$ cm.	✓ A side length of Square 1 ✓ CA value of r ✓ CA substitution in $T_n = ar^{n-1}$ ✓ CA same base in LHS and RHS ✓ CA answer (5) OR ✓ A area of square ✓ A value of a ✓ CA substitution in $T_n = ar^{n-1}$ ✓ CA same base in LHS and RHS ✓ CA answer (5)

QUESTION 3

3.1	$\sum_{k=10}^{25} (7-5k) = 7-5(10)+7-5(11)+7-5(12)+\dots \text{to 16 terms}$ $= -43-48-53+\dots \text{to 16 terms}$ $\therefore a = -43; \quad d = -5$ $n = 16$ $S_n = \frac{n}{2} [2a + (n-1)d]$ $= \frac{16}{2} [2(-43) + 15(-5)]$ $= -1288$ OR $a = -43; \quad l = 7-5(25) = -118$ $n = 16$ $S_n = \frac{n}{2} [a + l]$ $= \frac{16}{2} [-43 - 118]$ $= -1288$	✓ A values of a and d ✓ A value of n ✓ CA substitution ✓ CA answer (4) OR ✓ A values of a and l ✓ A value of n ✓ CA substitution ✓ CA answer (4)
3.2	$T_4 = a \cdot 4^2 + 4b + 6 = 16a + 4b + 6 = 26$ $16a + 4b = 20$ $4a + b = 5 \dots\dots\dots(1)$ $T_3 - T_2 = 7$ $9a + 3b + 6 - (4a + 2b + 6) = 7$ $5a + b = 7 \dots\dots\dots(2)$ $(2) - (1): \quad a = 2$ Substitute $a = 2$ in (1): $4(2) + b = 5$ $b = -5(2) + 7 = -3$	✓ A use $T_4 = 26$ to obtain equation i.t.o. a and b ✓ A use $T_3 - T_2 = 7$ to obtain equation i.t.o. a and b ✓ CA value of a ✓ CA value of b (4)

[8]

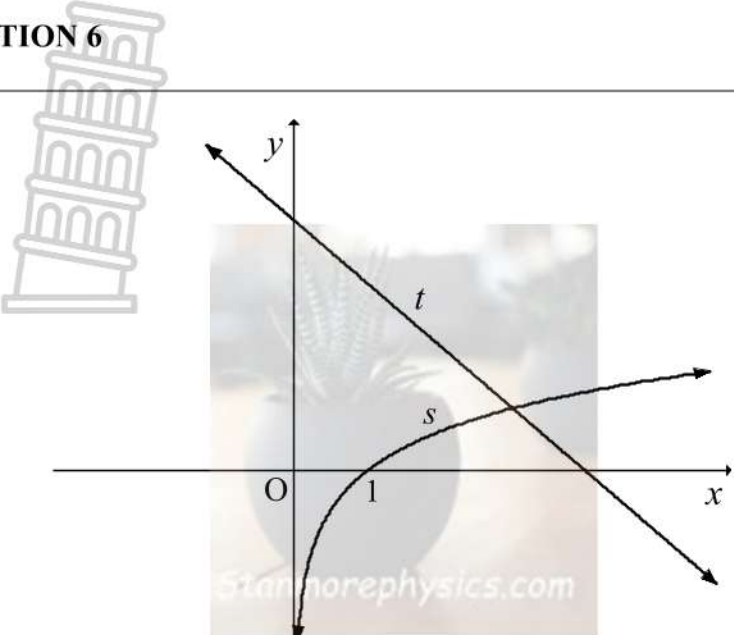
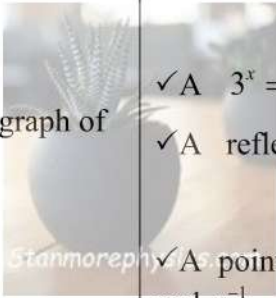
QUESTION 4

4.1	$x = 3$ $y = 2$	✓A $x = 3$ ✓A $y = 2$ (2)
4.2.1	For the x -intercept, $y = 0$: $\therefore 0 = \frac{-9}{x-3} + 2$ $-2(x-3) = -9$ $-2x = -15$ $x = 7\frac{1}{2}$	✓A substitute $y = 0$ ✓A x -intercept (2)
4.2.2	For the y -intercept, $x = 0$: $\therefore y = \frac{-9}{0-3} + 2$ $y = 5$	✓A y -intercept (1)
4.3		✓A shape ✓CA asymptotes ✓CA intercepts (3)
4.4	reflection around the y -axis	✓✓AA answer (2)
4.5	$-5 < p < -2$	✓✓CA; A answer (2)
[12]		

QUESTION 5

5.1	$R(0; -6)$	✓A answer (1)
5.2	$c = -6$ $\therefore y = mx - 6$ Substitute $(-7; 8)$: $8 = m(-7) - 6$ $m = -2$ $\therefore y = -2x - 6$	✓A $c = -6$ ✓CA substitute. $(-7; 8)$ ✓CA answer (3)
5.3	$g(x) = x^2 + 5x - 6$ $= x^2 + 5x + \left(\frac{5}{2}\right)^2 - \left(\frac{5}{2}\right)^2 - 6$ $= \left(x + \frac{5}{2}\right)^2 - \frac{49}{4}$	✓A $\left(x + \frac{5}{2}\right)^2$ ✓A $-\frac{49}{4}$ (2)
5.4	average gradient of TW = -4 $\frac{y-8}{x-(-7)} = -4$ $y-8 = -4(x+7)$ $y = -4x - 20$ $\therefore x^2 + 5x - 6 = -4x - 20$ $x^2 + 9x + 14 = 0$ $(x+7)(x+2) = 0$ $x \neq -7$ or $x = -2$ $\therefore W(-2; -12)$	✓A substitution for ave. gradient ✓CA y subject of the formula ✓CA substitute $y = x^2 + 5x - 6$ ✓CA factors ✓CA answer (5)
5.5	For x intercept of h : $-2x - 6 = 0$ $x = -3$ $\frac{g(x)}{h(x)} \leq 0$ for $-6 \leq x < -3$ or $x \geq 1$	✓CA x intercept of h ✓✓CA $-6 \leq x < -3$ ✓A $x \geq 1$ (4)
		[15]

QUESTION 6

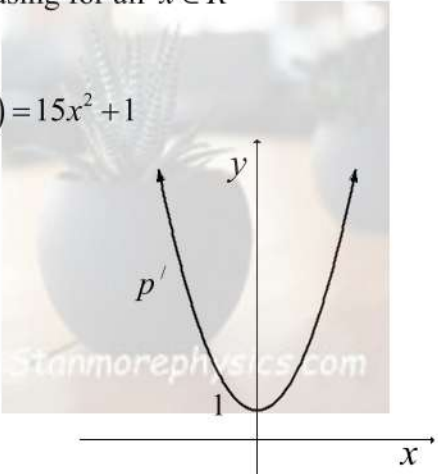
6.1		s: ✓ A shape ✓ A x-intercept of 1 (2)
6.2	$s^{-1}: x = \log_3 y$ $\therefore y = 3^x$ Answer only: Full marks	✓ A swapping of x and y ✓ A answer (2)
6.3	Rewrite $\log_3(4-x) = x$: $3^x = 4-x$ or: $3^x = -x+4$ Reflect the graph of s in the line $y = x$ to obtain the graph of the inverse: $s^{-1}(x) = 3^x$. The x-coordinate of the point of intersection between $t(x) = -x+4$ and $s^{-1}(x) = 3^x$ will be the solution of $3^x = 4-x$, and therefore also of: $\log_3(4-x) = x$.	 ✓ A $3^x = -x+4$ ✓ A reflect in the line $y = x$ ✓ A point of intersection between t and s^{-1} (3)
6.4	$x = 1$	✓ A answer (1)
[8]		

QUESTION 7

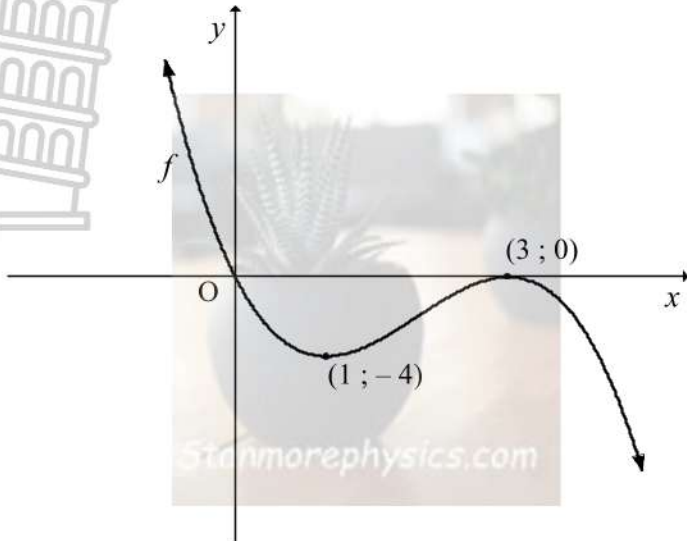
7.1	Let $P = x$; $A = 2x$; n = number of years $A = P(1+i)^n$ $2x = x\left(1 + \frac{0,073}{4}\right)^{4n}$ $2 = 1,01825^{4n}$ $4n = \log_{1,01825} 2$ $n = 9,58$ After 9,6 years.	✓ A $P = x$ and $A = 2x$ or $\frac{A}{P} = 2$ ✓ A substitution ✓ CA use of logarithms ✓ CA answer (4)
7.2	$F = \frac{x[(1+i)^n - 1]}{i}$ $F = \frac{2500\left[\left(1 + \frac{0,08}{12}\right)^{60} - 1\right]}{\frac{0,08}{12}}$ $= R183\,692,14$	✓ A $n = 60$ ✓ A $i = \frac{0,08}{12}$ ✓ CA substituting into correct formula ✓ CA answer (4)
7.3.1	$P = \frac{x[1 - (1+i)^{-n}]}{i}$ $82\,000 = \frac{3\,200\left[1 - \left(1 + \frac{0,12}{12}\right)^{-n}\right]}{\frac{0,12}{12}}$ $\left(1 + \frac{0,12}{12}\right)^{-n} = 1 - \frac{82\,000 \times \frac{0,12}{12}}{3\,200}$ $= 0,74375$ $-n = \log_{\left(1 + \frac{0,12}{12}\right)} 0,74375$ $n = 29,75281189...$ She will have to pay 30 instalments.	✓ A substituting into correct formula ✓ CA use of logarithms ✓ CA value of n ✓ CA answer (4)

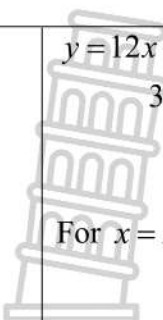
7.3.2	Outstanding balance after 29 instalments = present value of outstanding instalments $= \frac{x \left[1 - (1+i)^{-n} \right]}{i}$ $= \frac{3\,200 \left[1 - \left(1 + \frac{0,12}{12} \right)^{-0,75281189...} \right]}{\frac{0,12}{12}}$ $= R2388,08$ Final instalment = $2388,08 \left(1 + \frac{0,12}{12} \right)^1$ $= R2411,96$ OR OB = A – F $= P(1+i)^n - \frac{x \left[(1+i)^n - 1 \right]}{i}$ $= 82\,000 \left(1 + \frac{0,12}{12} \right)^{29} - \frac{3\,200 \left[\left(1 + \frac{0,12}{12} \right)^{29} - 1 \right]}{\frac{0,12}{12}}$ $= R2388,08$ Final instalment = $2388,08 \left(1 + \frac{0,12}{12} \right)^1$ $= R2411,96$ OR $82\,000 = \frac{3\,200 \left[1 - \left(1 + \frac{0,12}{12} \right)^{-29} \right]}{\frac{0,12}{12}} + \text{Final instalment} \left(1 + \frac{0,12}{12} \right)^{-30}$ $\text{Final instalment} = \left(82\,000 - \frac{3\,200 \left[1 - \left(1 + \frac{0,12}{12} \right)^{-29} \right]}{\frac{0,12}{12}} \right) \div \left(1 + \frac{0,12}{12} \right)^{-30}$ $= R2411,96$	✓CA substituting into correct formula ✓CA compounding ✓CA answer (3) OR ✓CA substituting into correct formula ✓CA compounding ✓CA answer (3)
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QUESTION 8

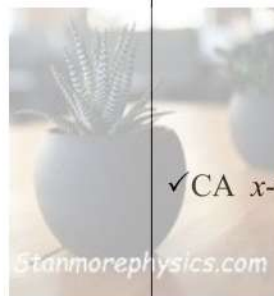
8.1	$f(x+h) = (x+h) - 3(x+h)^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{(x+h) - 3(x+h)^2 - (x - 3x^2)}{h}$ $= \lim_{h \rightarrow 0} \frac{x+h-3x^2-6xh-3h^2-x+3x^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h-6xh-3h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(1-6x-3h)}{h}$ $= \lim_{h \rightarrow 0} (1-6x-3h)$ $= 1-6x$ Penalise for incorrect notation, one mark, only in this question.	✓A expression for $f(x+h)$ ✓CA substitution ✓CA simplification ✓CA common factor ✓CA answer (5)
8.2	$D_x \left(\frac{4x^2 + x + 2\sqrt{x}}{2x^2} \right)$ $= D_x \left(2 + \frac{1}{2}x^{-1} + x^{-\frac{3}{2}} \right)$ $= -\frac{1}{2}x^{-2} - \frac{3}{2}x^{-\frac{5}{2}}$	✓A $2 + \frac{1}{2}x^{-1}$ ✓A $x^{-\frac{3}{2}}$ ✓CA $-\frac{1}{2}x^{-2}$ ✓CA $-\frac{3}{2}x^{-\frac{5}{2}}$ (4)
8.3	$p(x) = 5x^3 + x$ $p'(x) = 15x^2 + 1$ $15x^2 \geq 0$, for all $x \in R$ $15x^2 + 1 > 0$ for all $x \in R$ $\therefore p'(x) > 0$, for all $x \in R$ p is increasing for all $x \in R$ OR $p'(x) = 15x^2 + 1$  $\therefore p'(x) > 0$, for all $x \in R$ p is increasing for all $x \in R$	✓A derivative ✓A $15x^2 \geq 0$, for all $x \in R$ ✓A $p'(x) > 0$, for all $x \in R$ (3) OR ✓A derivative ✓A graph of $p'(x)$ is above x-axis for all $x \in R$ ✓A $p'(x) > 0$, for all $x \in R$ (3) (3)

QUESTION 9

9.1.1		✓A shape ✓A passing through origin ✓A x-intercept (3;0) ✓A turning point: (1;-4)	(4)
9.1.2	(3 ; 4)	✓A answer ✓A answer	(2)
9.1.3	$f(x) = -x(x-3)^2$ $= -x(x^2 - 6x + 9)$ $= -x^3 + 6x^2 - 9x$ $f'(x) = -3x^2 + 12x - 9$ $f''(x) = -6x + 12$	✓A $-x^3 + 6x^2 - 9x$ ✓CA $f'(x)$ ✓CA $f''(x)$	(3)
9.1.4	$f''(0) = -6(0) + 12 = 12$ $\therefore f''(0) > 0$ $\therefore \text{the graph of } f \text{ is concave up at } (0 ; 0).$	✓CA value of $f''(0)$ ✓CA show that $f''(0) > 0$ ✓CA answer	(3)
9.2	$y = 12x + k$ will be a tangent to g when: $3x^2 = 12$ $x^2 = 4$ $x = 2 \quad \text{or} \quad x = -2$ For $x = 2$: $x^3 + 1 = 12x + k$ $2^3 + 1 = 12(2) + k$ $\therefore k = -15$ For $x = -2$: $x^3 + 1 = 12x + k$ $(-2)^3 + 1 = 12(-2) + k$ $\therefore k = 17$ $y = 12x + k$ will be intersecting g at 3 distinct points for $-15 < k < 17$. OR	✓A equating derivatives ✓CA x-values ✓CA value of k ✓CA value of k ✓CA answer OR	(5)



9.2	$y = 12x + k$ will be a tangent to g when: $3x^2 = 12$ $x^2 = 4$ $x = 2 \quad \text{or} \quad x = -2$ For $x = 2$: $x^3 + 1 = 12x + k$ $2^3 + 1 = 12(2) + k$ $\therefore k = -15$ For $x = -2$: $x^3 + 1 = 12x + k$ $(-2)^3 + 1 = 12(-2) + k$ $\therefore k = 17$ $y = 12x + k$ will be intersecting g at 3 distinct points for $-15 < k < 17$. OR $g(x) = 12x + k$ $x^3 + 1 = 12x + k$ $x^3 - 12x + 1 = k$ Consider the graph of $x^3 - 12x + 1$: Turning points when $3x^2 - 12 = 0$ $x^2 = 4$ $x = 2 \quad \text{or} \quad x = -2$ For $x = 2$: $x^3 + 1 = 12x + k$ $2^3 + 1 = 12(2) + k$ $\therefore k = -15$ For $x = -2$: $x^3 + 1 = 12x + k$ $(-2)^3 + 1 = 12(-2) + k$ $\therefore k = 17$ $y = 12x + k$ will be intersecting g at 3 distinct points for $-15 < k < 17$.	✓A equating derivatives ✓CA x-values ✓CA value of k ✓CA value of k ✓CA answer (5) OR ✓A $x^3 + 1 = 12x + k$ ✓CA x-values ✓CA value of k ✓CA value of k ✓CA answer (5)
[17]		

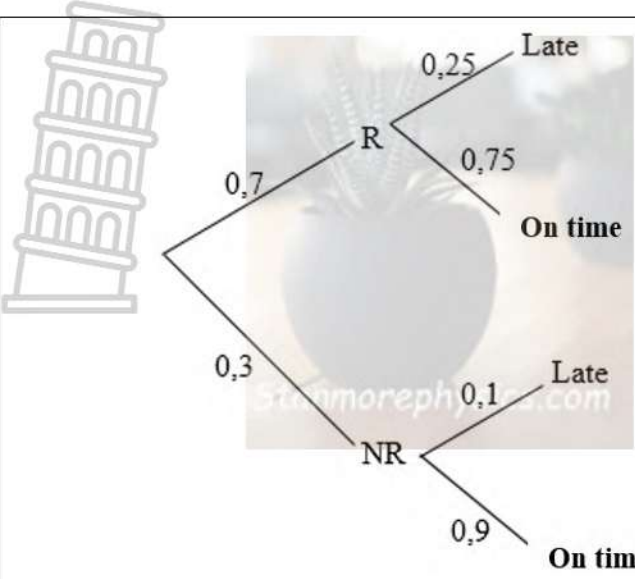


QUESTION 10

10.1	$\text{TSA of box} = 2(x)(x) + 2(x)(h) + 2(x)(h) = 2x^2 + 4xh$ $2x^2 + 4xh = 1350$ $h = \frac{1350}{4x} - \frac{x}{2}$ $\text{Volume} = x^2h$ $= x^2 \left(\frac{1350}{4x} - \frac{x}{2} \right)$ $V(x) = \frac{675x}{2} - \frac{x^3}{2}$	✓A expression for TSA ✓A equating to 1350 ✓A $h = \frac{1350}{4x} - \frac{x}{2}$ ✓A substitution into formula for volume of rectangular prism (4)
10.2	$V'(x) = \frac{675}{2} - \frac{3x^2}{2}$ For maximum volume: $V'(x) = 0$ $3x^2 = 675$ $x^2 = 225$ $x = 15 \text{ cm}$	✓A derivative ✓A derivative = 0 ✓CA answer (3)
[7]		

QUESTION 11

11.1.1	$P(A \text{ and } B) = P(A) \times P(B)$ $0,28 = (0,42 + 0,28) \times (0,28 + x)$ $0,4 = 0,28 + x$ $x = 0,4 - 0,28$ $x = 0,12$	✓A subst. into correct formula ✓A simplification ✓CA answer (3)
11.1.2	$y = 1 - 0,82 = 0,18$	✓CA answer (1)
11.1.3	$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $= 0,42 + 0,28 - 0,28$ $= 0,82$ OR $P(A \text{ or } B) = 0,42 + 0,28 + 0,12$ $= 0,82$ OR $P(A \text{ or } B) = 1 - y$ $= 0,82$	✓CA answer (1) OR ✓CA answer (1) OR ✓CA answer (1)

11.2	 $P(\text{on time when raining}) = 0,7 \times 0,75$ $P(\text{on time when not raining}) = 0,3 \times 0,9$ $P(\text{on time}) = (0,7 \times 0,75) + (0,3 \times 0,9)$ $= 0,795$	✓A $0,7 \times 0,75$ ✓A $0,3 \times 0,9$ ✓CA adding ✓CA answer (4)
11.3.1	$8! = 40320$	✓A answer (1)
11.3.2	$8.7.6.5 = 1680$	✓A answer (1)
11.3.3	$n(S) = 2!6! = 1440$ $n(\text{event}) = 2!3!3!2! = 144$ $P(\text{event}) = \frac{n(\text{event})}{n(S)} = \frac{144}{1440}$ $= \frac{1}{10}$ OR $n(S) = 2!6! = 2!720$ $= 2!(3!3! + 3!3!) = 2!72$ $= \frac{2!72}{2!720}$ $= \frac{1}{10}$	✓A $n(S)$ ✓A $n(\text{event})$ ✓CA $\frac{n(\text{event})}{n(S)}$ ✓CA answer (4)

[15]

TOTAL: 150