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#### September 2021 Preparatory Examination

QUEST	ΓΙΟΝ 1		
1.1.1		A✓ A✓	(2)
1.1.2		A√ standard form	
		CA✓ substitution in correct formula	
		CACA✓✓answers	
		(penalize 1 mark if rounding off is incorrect-once here for entire paper)	(4)
1.1.3			
		A√ Isolating surd	
		$A\checkmark$ squaring both sides	
		CA√ standard form CA√ factors	
	_	CA√answers and rejecting	(5)
	n/a		
1.1.4			
	-	$A \checkmark Writing as a positive index$	
		$CA\checkmark$ Standard form of equation	
		CA√ factors	
	-		
		CA✓ exponential forms	
		CA√answers	(5)

NSC Marking Guideline

	NSC Marking Guideline			
1.2	$x^2 - 5x + 4 \ge 0$		$A\checkmark x^2 - 5x + 4 \ge 0$	
	$(x-1)(x-4) \ge 0$		$A\checkmark$ factors CA $\checkmark$ end points $A\checkmark$ interval	(4)
	$x \leq 1$ or $x \geq 4$		OR	(4)
			If graphical solution is used: AA 2 marks for graph A /CA 2 marks for answer	(4)
1.3	$xy = 12 \rightarrow (1)$			
	$x - 4 = y  \rightarrow (2)$			
	Substituting (2) into (1):			
	x(x-4) = 12		A√ correct substitution	
	$x^2 - 4x - 12 = 0$		CA√ standard form	
	(x+2)(x-6) = 0		CA√ factors	
	$x = -2 \ or \ x = 6$		$CA \checkmark x/y - values$	
	y = -6 or $y = 2$		$CA \checkmark y/x$ values	(5)
				[25]

# QUESTION 2

2.1	$T_p = 3p - 2 = 1450$	A $\checkmark$ equating $p^{\text{th}}$ term to 1450	
	p = 484	$CA \checkmark p$ value	(2)
	Between the 484 <sup>th</sup> and 485 <sup>th</sup> terms	CA√answer	(3)
2.2	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		
	$2a = 3$ $\therefore a = \frac{3}{2}$	$A \checkmark a - value$	
	$3a + b = 1  \therefore b = -\frac{7}{2}$ $T_n = an^2 + bn + c$	$CA \checkmark b - value$	
	$T_{40} = \frac{3}{2}(40)^2 - \frac{7}{2}(40) + c = 2290$	CA√Substitution	
	2400 - 140 + c = 2290	CA√answer	
	c = 30		
			(4)
			[7]

3

4

# **QUESTION 3**

NSC Marking Guideline

3.1.1	$T_n = 8n + 57$	A✓ common difference CA✓ answer	(2)
3.1.2	$\begin{array}{l} T_n = 8n + 57 \\ T_{1000} = 8(1000) + 57 \\ T_{1000} = 8057 \end{array}$	CA✓ substitution into formula CA✓ answer	(2)
3.1.3	$S_n = \frac{n}{2} [a + T_n]$ $S_{1000} = \frac{1000}{2} [65 + 8057]$ $S_{1000} = 4061000$	CA ✓ correct substitution into sum formula CA ✓ answer	(2)
3.2	Arithmetic: $5; 5 + x; 5 + 2x;$ Geometric: $5; 5x; 5x^2; 5x^3;$ Now: $5x^4 = 80$ $x^4 = 16$ x = -2  or  2 Sequences are: 5; 7; 9  or 5; 3; 1	A $\checkmark$ Setting up equation A $\checkmark$ dividing by 5 CA $\checkmark x$ – values CA $\checkmark$ sequence CA $\checkmark$ sequence	(5)
			[11]

# **QUESTION 4**

$=\frac{3}{2}$ $20y + 45 + 360 = \frac{3}{2}$ $20y = -403,5$ $y = -20,175$ CA <th>4</th> <th><math display="block">\sum_{p=1}^{5} (4y+3p) + \sum_{k=4}^{7} 3.(2)^{k-1} = \sum_{j=1}^{\infty} \left(\frac{1}{3}\right)^{j-1}</math> <math display="block">4y+3+4y+6+4y+9+4y+12+4y+15</math> <math display="block">= 20y+45</math> <math display="block">3.2^{3}+3.2^{4}+3.2^{5}+3.2^{6}=360</math> <math display="block">S_{\infty} = \frac{a}{1-r}</math> <math display="block">= \frac{1}{1-\frac{1}{3}}</math></th> <th>A√20y + 45 A√360 A√ correct substitution into sum to infinity formula <math>CA\sqrt{\frac{3}{2}}</math></th> <th></th>	4	$\sum_{p=1}^{5} (4y+3p) + \sum_{k=4}^{7} 3.(2)^{k-1} = \sum_{j=1}^{\infty} \left(\frac{1}{3}\right)^{j-1}$ $4y+3+4y+6+4y+9+4y+12+4y+15$ $= 20y+45$ $3.2^{3}+3.2^{4}+3.2^{5}+3.2^{6}=360$ $S_{\infty} = \frac{a}{1-r}$ $= \frac{1}{1-\frac{1}{3}}$	A√20y + 45 A√360 A√ correct substitution into sum to infinity formula $CA\sqrt{\frac{3}{2}}$	
[7]		$= \frac{3}{2}$ $20y + 45 + 360 = \frac{3}{2}$ 20y = -403.5 y = -20.175	CA√equation CA√simplifying CA√answer	[7]

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NSC Marking Guideline

#### **QUESTION 5**

 $A\checkmark x = 1$ x = 1 and y = 2(2) 5.1  $A \checkmark y = 2$ 5.2 *y* – intercept :(0 ; 6)  $A \checkmark y$  $x - \text{intercept:} \frac{4}{x-1} = 2$ intercept x - 1 = 2 $\mathbf{A}\checkmark x-1=2$ x = 3 $CA\checkmark x -$ (3; 0) intercept (co-ordinate (3) form not needed) 5.3 CA**√***x,y* intercepts 6 CA√both asymptotes A√shape g (3) 0 1 [8]

**QUESTION 6** 

6

NSC Marking Guideline

6.1	$f'(x) = -2x + 4 = 0$ or $x = -\frac{4}{3}$	A $\checkmark$ derivative and equal to 0/	
	$\int (x) - 2x + 4 = 0$ of $x - 2(-1)$	Substitution into formula	
	x = 2		
	y = f(2) = -4 + 8 + 5 = 9	$CA \checkmark Axis of symmetry value$	
	$C(2 \cdot 9)$	CA✓Maximum value	(3)
6.2	$y \le 9$	CA√answer	(1)
63	$-x^2 + 4x + 5 = 0$		
0.5		A✓ standard form	
	$x^2 - 4x - 5 = 0$		
	(x+1)(x-5) = 0	CA√ factors	
	$x = -1 \ or \ x = 5$	$CA \checkmark x$ - values	
	AB = 6 units	CA√answer	(4)
6.4	m = -1  and  c = 5 $y = -x + 5$	CACA ✓ ✓ answer	(2)
6.5	T(4;5)	CACA✓✓answer	(2)
6.6.1	m = 0	A✓ answer	(1)
6.6.2	9 = -x + 5	CA√Equating equation to 9	(2)
	x = -4 E(-4;9)	$CA \checkmark x - value$	
6.7	f'(x) = -2x + 4 = -1	A $\checkmark$ Derivative equal to $-1$	
	5		
	$x = \frac{1}{2}$	$CA \checkmark x - value$	
	$(5)^2$ $(5)$ 35	$CA \checkmark v - value$	
	$y = -(\frac{1}{2}) + 4(\frac{1}{2}) + 5 = \frac{1}{4}$		
	35 5 ,		
	$\frac{1}{4} = -\frac{1}{2} + k$	CA✓ substitution into equation of line	
	$k = \frac{45}{2}$	CA✓ answer	(5)
	4		
			[20]

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## **QUESTION 7**

#### NSC Marking Guideline

7.1	$y = log_a x$		
	$-1 = log_a 0,5$	$A\checkmark$ substitution of point P	
	$a^{-1} = 0,5 = 2^{-1}$	CA✓Writing in exponential form	
	a = 2	CA√answer	(3)
7.2	$y = 2^x$	CACA√✓	(2)
7.3	$x \in R$ or $x \in (-\infty; \infty)$	A√answer	(1)
7.4	$\log_2 x = -1$	CA v end points	
	$x = 2^{-1} = \frac{1}{2}$	<b>Can be solved by log inequalities</b> .	(2)
	$0 < x \le \frac{1}{2}$	Answer Only – Full marks	
			[8]
QUES'	TION 8		

#### **QUESTION 8**

8.1	$A = P(1-i)^n$		
	$= 500\ 000(1 - 8,5\%)^{12}$	A $\checkmark$ value of <i>n</i>	
	= <i>R</i> 172 196	A $\checkmark$ value of <i>i</i> CA $\checkmark$ answer	(3)
			(0)
8.2.1	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$		
	Г. (	A $\checkmark$ value of <i>n</i>	
	$3300 \left  1 - \left( 1 + \frac{16\%}{12} \right)^{-3} \right $	A $\checkmark$ value of <i>i</i>	
	$= \frac{1}{16\%}$	CA✓ Substitution into formula	
	$= R135\ 701,63$	CA✓ answer	(4)
8.2.2	$P = \frac{x[1 - (1 + i)^{-n}]}{x[1 - (1 + i)^{-n}]}$		
	i i for		
	$x \left[ 1 - \left( 1 + \frac{16\%}{100} \right)^{-60} \right]$	A ✓ P value	
	$125\ 701,6304 = \frac{127}{16\%}$	CA✓ substitution into formula	
	$\frac{10 70}{12}$		(3)
	x = R3056,82	CA✓ answer	
8.2.3	No. Deposit: 60 x R3300 = R198 000,00	A√R198 000	
	With Deposit: R10 000 + 60 x R3056,82		
	= R 193 409,20	A√√193 409,20	
	Savings: R4590,80	CA√answer	(4)
			[14]
			[[1]]

## NSC Marking Guideline QUESTION 9(penalize 1 mark once for incorrect notation in this question)

9.1	$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$	A√formula	
	$f'(x) = \lim_{h \to 0} \frac{(x+h)^2 + 5(x+h) - 6 - (x^2 + 5x - 6)}{h}$	A✓substitution	
	$f'(x) = \lim_{h \to 0} \frac{x^2 + 2xh + h^2 + 5x + 5h - x^2 - 5x + 6}{h}$	CA√ simplification of numerator	
	$f'(x) = \lim_{h \to 0} \frac{2xh + h^2 + 5h}{h}$		
	$f'(x) = \lim_{h \to 0} \frac{h(2x+h+5)}{h}$	CA√ factorization	
	f'(x) = 2x + 5	CA✓answer	(5)
	OR $f(x+h) = (x+h)^2 + 5(x+h) - 6$	OR	
	$f(x + h) = x^{2} + 2xh + h^{2} + 5x + 5h - 6$ $f(x + h) - f(x) = 2xh + h^{2} + 5h$ $f(x + h) - f(x) = 2xh + h^{2} + 5h$	A $\checkmark$ value of $f(x+h)$ CA $\checkmark$ simplification	
	$\frac{\frac{h}{f(x+h) - f(x)}}{h} = \frac{h(2x+h+5)}{h}$	CA√ factorization	
	$f'(x) = \lim_{h \to 0} (2x + h + 5)$ f'(x) = 2x + 5	A√ formula CA√ answer	(5)
9.2.1	$f(x) = 3x(\sqrt{x} - 4)$ $f(x) = 3x^{\frac{3}{2}} - 12x$	A√rewriting in exponential form	
	$f'(x) = \frac{9}{2}x^{\frac{1}{2}} - 12$	CACA ✓ ✓ derivatives	(3)
9.2.2	$y = \frac{x^3 - 4x}{2 - x}$		
	$y = \frac{x(x-2)(x+2)}{-(x-2)} = -x^2 - 2x$	A√factors A√simplified expression	
	$\frac{dy}{dx} = -2x - 2$	$CACA \checkmark \checkmark$ each term	(4)
			[12]

8

## **QUESTION 10**

#### NSC Marking Guideline

10.2 $0 = -1 + b - c + 4$ $b - c = -3$ $f'(x) = 3x^2 + 2bx + c$ $0 = 3(0)^2 + 2b(0) + c$ $c = 0$ $b = -3$ A ✓ substitution of point (-1 ;0) $A \checkmark$ equation $A \checkmark$ derivative $A \checkmark$ substitution of point (-1 ;0) into derivative(4)10.3 $f(x) = x^3 - 3x^2 + 4$ $f'(x) = 3x^2 - 6x$ $f(5) = 3(5)^2 - 6(5) = 45$ $f(5) = (5)^3 - 3(5)^2 + 4 = 54$ $54 = 45(5) + c$ $c = -171$ $y = 45x - 171$ A ✓ gradient value of tangent $A \checkmark y - value of tangent$ 10.4 $0 < k < 4$ $A \checkmark answer$ (4)10.5 $f'(x) = 3x^2 - 6x = 0$ $3x(x - 2) = 0$ $x = 0 \text{ or } x = 2$ $y = 4 \text{ or } y = 0$ $B(2; 0)$ $B'(-2; 3)$ $CA \checkmark x - value CA \checkmark y - value$ $CA \checkmark x - value CA \checkmark y - value$	10.1	<i>d</i> = 4	A√Answer	(1)
$ \begin{array}{c} b - c = -3 \\ f'(x) = 3x^2 + 2bx + c \\ 0 = 3(0)^2 + 2b(0) + c \\ c = 0 \\ b = -3 \end{array} \qquad \qquad \begin{array}{c} A\checkmark \text{ equation} \\ A\checkmark \text{ derivative} \\ A\checkmark \text{ substitution of point (-1 ;0)} \\ \text{into derivative} \end{array} \qquad $	10.2	0 = -1 + b - c + 4	A $\checkmark$ substitution of point (-1 ;0)	
$ \begin{array}{c} f'(x) = 3x^2 + 2bx + c \\ 0 = 3(0)^2 + 2b(0) + c \\ c = 0 \\ b = -3 \end{array} \qquad \begin{array}{c} A \checkmark \text{ derivative} \\ A \checkmark \text{ substitution of point (-1 ; 0)} \\ \text{into derivative} \end{array} \qquad (4) \\ \hline 10.3 \qquad f(x) = x^3 - 3x^2 + 4 \\ f'(x) = 3x^2 - 6x \\ f'(5) = 3(5)^2 - 6(5) = 45 \\ f(5) = (5)^3 - 3(5)^2 + 4 = 54 \\ 54 = 45(5) + c \\ c = -171 \\ y = 45x - 171 \end{aligned} \qquad \begin{array}{c} A \checkmark \text{ gradient value of tangent} \\ A \checkmark \text{ gradient value of tangent} \\ A \checkmark \text{ gradient value of tangent} \end{aligned} \qquad (4) \\ \hline 10.4 \qquad 0 < k < 4 \\ \hline 10.5 \qquad f'(x) = 3x^2 - 6x = 0 \\ 3x(x - 2) = 0 \\ x = 0 \text{ or } x = 2 \\ y = 4 \text{ or } y = 0 \\ B(2; 0) \\ B'(-2; 3) \end{aligned} \qquad \begin{array}{c} CA \checkmark x - \text{value} \\ CA \checkmark x - \text{value} \\ CA \checkmark x - \text{value} \\ CA \checkmark x - \text{value} \end{aligned} \qquad (4) \\ \hline \end{array}$		b - c = -3	A√ equation	
$\begin{array}{c} 0 = 3(0)^{2} + 2b(0) + c \\ c = 0 \\ b = -3 \end{array} \qquad $		$f'(x) = 3x^2 + 2bx + c$	A√derivative	
$\begin{array}{c} c = 0 \\ b = -3 \end{array} \qquad $		$0 = 3(0)^2 + 2b(0) + c$	A $\checkmark$ substitution of point (-1 ;0)	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		c = 0	into derivative	
10.3 $f(x) = x^3 - 3x^2 + 4$ $f'(x) = 3x^2 - 6x$ $f'(5) = 3(5)^2 - 6(5) = 45$ $f(5) = (5)^3 - 3(5)^2 + 4 = 54$ $54 = 45(5) + c$ $c = -171$ $y = 45x - 171$ 10.4 $0 < k < 4$ 10.5 $f'(x) = 3x^2 - 6x = 0$ $3x(x - 2) = 0$ $x = 0$ or $x = 2$ $y = 4$ or $y = 0$ $B(2; 0)$ $B'(-2; 3)$		b = -3		(4)
10.3 $f(x) = x^3 - 3x^2 + 4$ A $f'(x) = 3x^2 - 6x$ $f'(5) = 3(5)^2 - 6(5) = 45$ A       gradient value of tangent $f(5) = (5)^3 - 3(5)^2 + 4 = 54$ A $A \checkmark$ gradient value of tangent $54 = 45(5) + c$ CA       CA       c - value $y = 45x - 171$ CA       AA       answer       (4)         10.4       0 < k < 4       AA       AA       answer       (2)         10.5 $f'(x) = 3x^2 - 6x = 0$ CA       CA       x - values $y = 4$ or $y = 0$ CA       CA       x - values       (2)         B(2; 0)       B'(-2; 3)       CA       X - value CA       (4)				
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	10.3	$f(x) = x^3 - 3x^2 + 4$		
$ \begin{cases} f'(5) = 3(5)^2 - 6(5) = 45 \\ f(5) = (5)^3 - 3(5)^2 + 4 = 54 \\ 54 = 45(5) + c \\ c = -171 \\ y = 45x - 171 \end{cases} $ $ \begin{array}{c} A\checkmark \ y - value \ of \ tangent \\ A\checkmark \ y - value \ tangent \\ A\land \ y - value \ tangent \ y - value \ tangent \\ A\land \ y - value \ tangent \ y - value \ tangent \\ A\land \ y - value \ y - value \ tangent \ y - value \ $		$f'(x) = 3x^2 - 6x$		
$f(5) = (5)^3 - 3(5)^2 + 4 = 54$ $A \checkmark y - value of tangent$ $54 = 45(5) + c$ $CA \checkmark c - value$ $c = -171$ $CA \checkmark c - value$ $y = 45x - 171$ $CA \checkmark answer$ 10.4 $0 < k < 4$ 10.5 $f'(x) = 3x^2 - 6x = 0$ $3x(x - 2) = 0$ $CA \checkmark x - values$ $y = 4 \text{ or } y = 0$ $B(2; 0)$ $CA \checkmark x - value CA \checkmark y - value$ $B'(-2; 3)$ $CA \checkmark x - value CA \checkmark y - value$		$f'(5) = 3(5)^2 - 6(5) = 45$	$A\checkmark$ gradient value of tangent	
$54 = 45(5) + c$ $CA \checkmark c - value$ (4) $y = 45x - 171$ $CA \checkmark answer$ (4) $10.4$ $0 < k < 4$ $AA \checkmark answer$ (2) $10.5$ $f'(x) = 3x^2 - 6x = 0$ $(x - 2) = 0$ (2) $x = 0$ or $x = 2$ $CA \checkmark x - values$ $CA \checkmark y - values$ $y = 4$ or $y = 0$ $CA \checkmark x - value CA \checkmark y - value$ (4)		$f(5) = (5)^3 - 3(5)^2 + 4 = 54$	$A \checkmark y$ – value of tangent	
$c = -171$ $y = 45x - 171$ $CA \checkmark c - value$ $CA \checkmark answer$ (4)10.4 $0 < k < 4$ $AA \checkmark answer$ (2)10.5 $f'(x) = 3x^2 - 6x = 0$ $3x(x - 2) = 0$ $x = 0 \text{ or } x = 2$ $y = 4 \text{ or } y = 0$ $B(2; 0)$ $B'(-2; 3)$ $CA \checkmark x - values$ $CA \checkmark x - value CA \checkmark y - value(4)$		54 = 45(5) + c		
$y = 45x - 171$ CAV answer       (4)         10.4 $0 < k < 4$ AAV answer       (2)         10.5 $f'(x) = 3x^2 - 6x = 0$ (2)       (2)         10.5 $f'(x) = 3x^2 - 6x = 0$ (2)       (2)         10.5 $f'(x) = 3x^2 - 6x = 0$ (2)       (2)         10.5 $f'(x) = 3x^2 - 6x = 0$ (2)       (2) $x = 0$ or $x = 2$ $x = 0$ or $x = 2$ $CA \checkmark x$ - values       (2) $B(2; 0)$ $B'(-2; 3)$ $CA \checkmark x - value CA \checkmark y - value$ (4)		c = -171	$CA \checkmark c - value$	
10.4 $0 < k < 4$ AA $\checkmark$ answer       (2)         10.5 $f'(x) = 3x^2 - 6x = 0$ $3x(x-2) = 0$ CA $\checkmark x - values$ $x = 0 \text{ or } x = 2$ $y = 4 \text{ or } y = 0$ CA $\checkmark x - values$ B(2;0)       B'(-2;3)       CA $\checkmark x - value CA \checkmark y - value$ (4)		y = 45x - 171	CA✓ answer	(4)
10.5 $ \begin{cases} f'(x) = 3x^2 - 6x = 0 \\ 3x(x-2) = 0 \\ x = 0 \text{ or } x = 2 \\ y = 4 \text{ or } y = 0 \\ B(2;0) \\ B'(-2;3) \end{cases} $ CA\$\sigma\$ x - values CA\$\sigma\$ y - value (4)	10.4	0 < k < 4	AA√answer	(2)
$\begin{vmatrix} 3x(x-2) = 0 \\ x = 0 \text{ or } x = 2 \\ y = 4 \text{ or } y = 0 \\ B(2;0) \\ B'(-2;3) \end{vmatrix} \qquad $	10.5	$f'(x) = 3x^2 - 6x = 0$		
$ \begin{array}{c c} x = 0 & or & x = 2 \\ y = 4 & or & y = 0 \\ B(2;0) \\ B'(-2;3) \end{array} \end{array} \begin{array}{c} CA\checkmark x - values \\ CA\checkmark y - values \\ CA\checkmark x - value CA\checkmark y - value \end{array} $ (4)		3x(x-2) = 0		
y = 4  or  y = 0 B(2;0) B'(-2;3) $CA \checkmark y - \text{values}$ CA \screw y - value (4)		x = 0  or  x = 2	$CA \checkmark x$ - values	
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		y = 4  or  y = 0	$CA \checkmark y$ - values	
$  B'(-2;3)   CA \checkmark x - value CA \checkmark y - value $ (4)		B(2;0)		
		B'(-2;3)	$CA \checkmark x - value CA \checkmark y - value$	(4)
[15]				[15]

## **QUESTION 11**

11.1	A(-2;5) (0;3) (1;1) (-3;0) (-3;0)	A $\checkmark$ Local Maximum point A $\checkmark$ Local Minimum point A $\checkmark x$ – intercept A $\checkmark y$ – intercept A $\checkmark y$ shape	(5)
11.2.1	-3 < x < 0	CACAVV	(2)
11.2.2	(-2;-5)	CACA✓✓	(2)
			[9]

#### NSC Marking Guideline

### **QUESTION 12**

12.1	8!	A√8!	
	= 40 320	A✓40 320	(2)
12.2	$1 \times 6! \times 1$	$A\checkmark\checkmark1\times6!\times1$	
	= 720	A√720	(3)
12.3	Probability of a word starting with P and ending		
	with C	CA√Numerator	
	$\frac{720}{1} - \frac{1}{1} - 179\% - 0.0179$	CA denominator	
	40 320 56 1,7 7 70 - 0,017 9		
		$\frac{720}{40320}$ or $\frac{1}{56}$ or 0,0179 or 1,79%	(2)
			[7]

### **QUESTION 13**

13.1	160	A√answer	(1)
13.2	$P(Male) = \frac{60}{160} = \frac{3}{8} = 0,375 = 37,5\%$	AA $\checkmark \checkmark \frac{60}{160}$ or $\frac{3}{8}$ or 0,375 or 37,5 %	(2)
13.3	$P(Male choosing coffee) = P(Male) \times P(coffee)$	A Condition for independent events	
	$\frac{b}{160} = \frac{60}{160} \times \frac{80}{160}$ $\frac{b}{160} = \frac{3}{160}$	AA✓✓ Substitution into equation	
	$160 \ 16$ b = 30	A√Answer	(4)
			[7]

**Total: 150** 

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