education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL
SENIOR CERTIFICATE

GRADE 10

MATHEMATICS

COMMON TEST

JUNE 2018

MARKS: 100

TIME: 2 hours

This question paper consists of 8 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions:

1. This question paper consists of 8 questions.

2. Answer ALL the questions.

3. Clearly show ALL calculations, diagrams, graphs, et cetera, which you have used in determining the 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. Number the answers correctly according to the numbering system used in this question paper.

8. Write neatly and legibly.

QUESTION 1

1.1 Determine the product of the following expression:

$3xy\left(x^2 y - \dfrac{xy}{3}\right)$ (2)

1.2 Factorise the following expressions fully:

1.2.1 $\dfrac{1}{2}x^2 - 2$ (2)

1.2.2 $p^3 - x^3 - p + x$ (3)

1.3 Without using a calculator, simplify the following expressions fully:

1.3.1 $\sqrt{9x^8 + 16x^8}$ (2)

1.3.2 $\sqrt{9x^8 \times 16x^8}$ (2)

[11]

QUESTION 2

2.1 Solve for x in the following equations:

2.1.1 $2(1 - 3x) = 2$ (2)

2.1.2 $\dfrac{3 - 2x}{5} \geq -7$ (2)

2.1.3 $2x(x + 1) - (x - 3) = 6$ (4)

2.2 Solve for t in the following equations:

2.2.1 $3^t \times 9^{t+3} = 27^3$ (3)

2.2.2 $\dfrac{m}{t} = \dfrac{t}{a+b}$ $\qquad a \neq b$ (2)

[13]

QUESTION 3

3.1 The patterns drawn below are made of matchsticks:
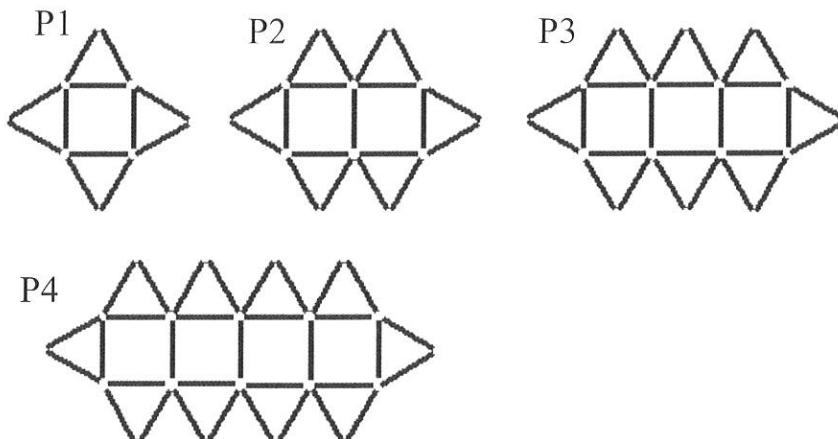
3.1.1 Write down the number of triangles in the next two patterns P5 and P6. (1)

3.1.2 Calculate how many triangles there will be in the 60th pattern. (3) (2)

3.2 Given the linear pattern:

$$x + 1; \quad 2x + 1; \quad 10; \quad 13$$

3.2.1 Calculate the value of x. (2)

3.2.2 Write down the numeric values of term 1 and term 2. (1)

3.2.3 Find the general term, T_n, of the pattern (2)

[9]

QUESTION 4

Given: $f(x) = \dfrac{6}{x} - 3$ and $g(x) = x + c$

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

4.2   Calculate the x-intercept of $f(x)$.   (2)

4.3   Calculate the value of c if $g(x)$ is the line of symmetry of $f(x)$.   (2)

4.4   Write down the domain and range of $f(x)$.   (2)

4.5   Write down the equation of $h(x)$ if $h(x)$ is a reflection of $f(x)$ about the y-axis.   (1)

[9]

QUESTION 5

The graph represents $f(x) = 2x^2 - 2$ and $g(x) = a^x + q$.

$(-2; 1\frac{1}{4})$ is a point of intersection of f and g.
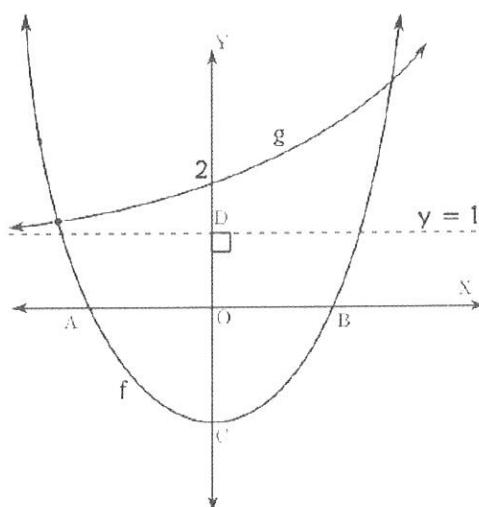
5.1   Calculate the co-ordinates of A, B and C.   (5)

5.2   Calculate the value of a and q.   (2)

5.3   Write down the length of CD.   (1)

5.4   State the range of f.   (1)

5.5   For which value(s) of x is:

   5.5.1 $f(x) \leq 0$ (1)

   5.5.2 $f(x)$ increasing   (1)

   5.5.3 $g(x) < f(x)$, if $x < 0$ (1)

[12]

QUESTION 6

6.1 Use a calculator to evaluate the following expressions, correct to 2 decimal places:

6.1.1 $\dfrac{\tan 70^{\circ}}{3} + \sqrt{\cos^2 85^{\circ}}$ (1)

6.1.2 $5 \operatorname{cosec} 5x$ if $x = 99^{\circ}$ (1)

6.2 Simplify the following WITHOUT the use of a calculator:

$$\dfrac{\tan^2 30^{\circ}.\sec 45^{\circ}}{\dfrac{1}{\sin^2 60^{\circ}}}.$$ (4)

6.3 If $\tan \theta = \dfrac{8}{6}$, $\theta \in [180^{\circ}; 360^{\circ}]$, use a diagram to calculate the following:

$$\sin \theta - \cos \theta$$ (4)

6.4 If $\sin \alpha = p$, where $0^0 < \alpha < 90^0$, write the following in terms of p.

6.4.1 $\cos^2 \alpha$ (2)

6.4.2 $\tan \alpha$ (1)

6.5 Solve for x, correct to 2 decimal places, for $0^{\circ} \leq x \leq 90^{\circ}$:

6.5.1 $\sin 2x = 0{,}682$ (2)

6.5.2 $\sin(x - 40^{\circ}) = 0{,}58$ (2)

[17]

QUESTION 7

7.1   The graph of f is drawn below:
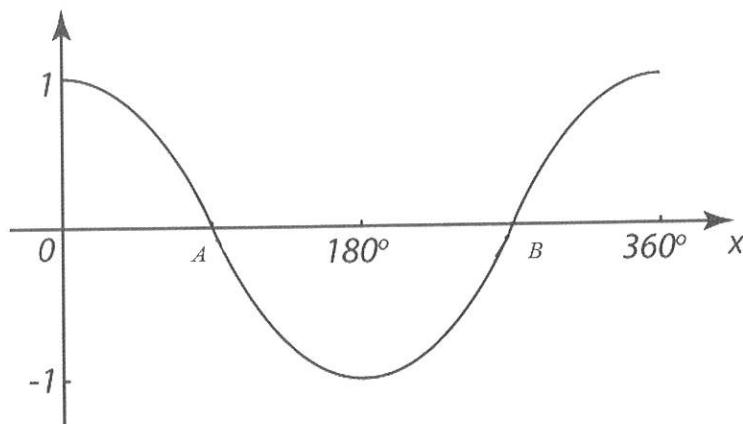
7.1.1   Determine the equation of f.   (1)

7.1.2   Write down the co-ordinates of A and B.   (2)

7.1.3   State the domain and range of f.   (2)

7.1.4   Write down the amplitude and period of f.   (2)

7.1.5   Determine the equation of $g(x)$ if g is the graph of f reflected across the x- axis
         and shifted 2 units down.   (2)

7.2   On the **same** system of axis, sketch the graphs of

$$f(x) = sinx - 1 \quad \text{and} \quad g(x) = 2\cos x \quad \text{for } x \in [0°; 360°]$$

       Clearly indicate the x and y intercepts.   (6)

                                                                                                                      [15]

QUESTION 8

Answer the questions below **giving appropriate reasons** for your answers.

8.1   Given: ΔABC, with AB = 14cm and BC = 16cm. AC = a units, DE = b units.
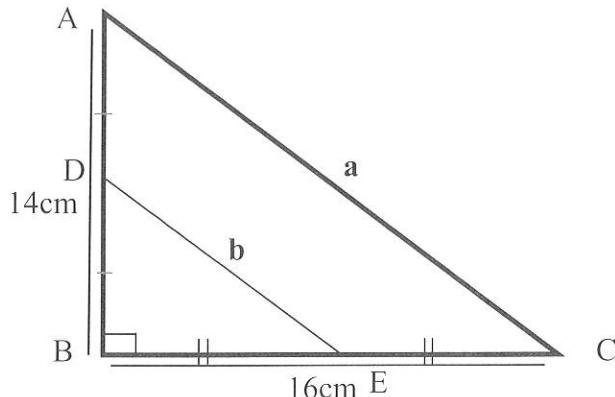
8.1.1   Calculate the length of **a (AC)** correct to the nearest whole number.   (2)

8.1.2   **Hence**, write down the length of **b (DE)**.   (2)

8.2   Given: PQRS is a parallelogram with $R\hat{Q}V = 119°$. PV and WR are straight lines.
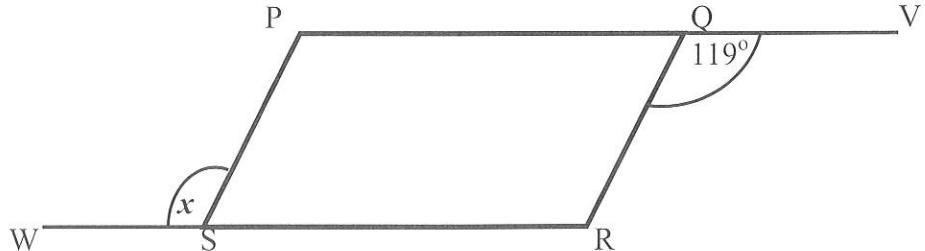
Calculate the magnitude of **x**.   (4)

8.3   Refer to the diagram drawn below.
AD = CD and PQ∥RS. AR and FC are straight lines. RS and FC intersect at E
also PQ intersect FC at B
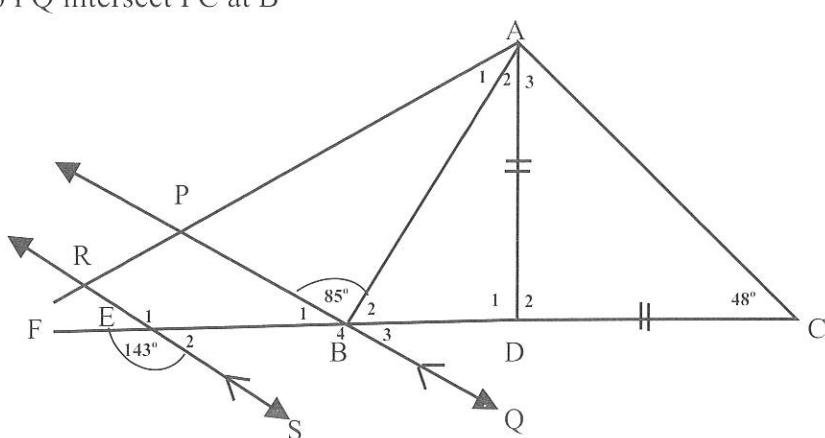
Determine the sizes of the following angles, giving appropriate reasons for
your answers.

8.3.1 $\hat{D}_1$ (2)

8.3.2 $\hat{B}_1$ (2)

8.3.3 $\hat{A}_2$ (2)

[6]

[14]

TOTAL MARKS: 100

INCL GR10 +11 MATH + MLIT - P.1

QUESTION 1

1.1	$3xy(x^2y - \dfrac{xy}{3})$	$3x^3y^2$ ✓	
	$= 3x^3y^2 - x^2y^2$	$-x^2y^2$ ✓	(2)
1.2.1	$\dfrac{1}{2}x^2 - 2$		
	$= \dfrac{1}{2}(x^2 - 4)$	✓ common factor	
	$= \dfrac{1}{2}(x-2)(x+2)$	✓ diff. of squares	(2)
1.2.2	$p^3 - x^3 - p + x$		
	$(p-x)(p^2 + px + x^2) - (p - x)$	✓✓	
	$(p-x)(p^2 + px + x^2 - 1)$	✓	(3)
1.3.1	$\sqrt{9x^8 + 16x^8}$		
	$= \sqrt{25x^8}$	✓	
	$= 5x^4$	✓	(2)
1.3.2	$\sqrt{9x^8 \times 16x^8}$		
	$= 3x^4 \times 4x^4$	✓	
	$= 12x^8$	✓	(2) [11]

QUESTION 2

2.1.1	$2(1-3x) = -2$ $\qquad$ $2(1-3x) = -2$		
	$2 - 6x = -2$ $\qquad\quad$ $1 - 3x = -1$		
	$-6x = -4$ $\qquad$ OR $\qquad$ $-3x = -2$	✓	
	$x = \dfrac{2}{3}$ $\qquad\qquad\qquad$ $x = \dfrac{2}{3}$	✓	(2)
2.1.2	$\dfrac{3 - 2x}{5} \geq -7$		
	$3 - 2x \geq -35$	✓	
	$-2x \geq -38$		
	$x \leq 19$	✓	(2)
2.1.3	$2x(x+1) - (x-3) = 6$		
	$2x^2 + 2x - x + 3 = 6$	✓ expansion	
	$2x^2 + x - 3 = 0$	✓ std form	
	$(2x+3)(x-1) = 0$	✓ factors	
	$x = -\dfrac{3}{2}$ or $x = 1$	✓ both answers	(4)

Please turn over

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MARKING GUIDELINE

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Please turn over

2.2.1	$3^t \times 9^{t+3} = 27^3$		
	$3^t \times (3^2)^{t+3} = (3^3)^3$		
	$3^t \times 3^{2t+6} = 3^9$		
	$3^{3t+6} = 3^9$	✓ prime base 3	
	$3t + 6 = 9$		
	$3t = 3$	✓ equating exponents	
	$t = 1$		(3)
2.2.2	$\dfrac{m}{t} = \dfrac{t}{a+b}$	✓	
	$t^2 = m(a+b)$		
	$t = \pm\sqrt{m(a+b)}$	✓	(2) [13]

QUESTION 3

3.1.1	12 : 14	✓ 12 and 14	(1)
3.1.2	$T_n = an + b$		
	$T_n = 2n + b$	✓ b = 2	
	$4 = 2(1) + b$		
	$b = 2$	✓ sub n = 60	
	$T_{60} = 2(60) + 2$		
	$= 122$	✓ answer	(3)
3.2.1	$x+1;\ 2x+1;\ 10;\ 13$		
	$2x+1 - (x+1) = 3$ or $10 - (2x+1) = 3$	✓	
	$x = 3$ $x = 3$	✓	(2)
3.2.2	4 : 7	✓ 4 and 7	(1)
3.2.3	$T_n = an + b$		
	$4 = 3(1) + b$	✓ 1	
	$b = 1$		
	$T_n = 3n + 1$	✓ 3n	(2) [9]

QUESTION 4

4.1	$x = 0$	✓	
	$y = -3$	✓ y = 0	(2)
4.2	$f(x) = \dfrac{6}{x} - 3$		
	$0 = \dfrac{6}{x} - 3$		
	$3 = \dfrac{6}{x}$		
	$x = 2$	✓	(2)

4.3	$g(x) = x + c$	✓	
	$-3 = 0 + c$		
	$c = -3$	✓	(2)
4.4	Domain : $x \in R,\ x \neq 0$	✓	
	Range : $y \in R,\ y \neq -3$	✓	(2)
4.5	$h(x) = -\dfrac{6}{x} - 3$	✓	(1) [9]

QUESTION 5

5.1	$f(x) = 2x^2 - 2$		
	x-intercept, let y = 0 : $2x^2 - 2 = 0$	✓	
	$2(x^2 - 1) = 0$		
	$(x-1)(x+1) = 0$	✓ A(-1;0)	
	$x = 1$ or $x = -1$	✓ B(1;0)	
	A(-1;0) B(1;0)	✓ C(0;-2)	
	y-intercept, let x = 0 : $y = -2$		
	C(0;-2)		(5)
5.2	$g(x) = a^x + q$		
	$\dfrac{5}{4} = a^{-2} + 1$	✓ q = 1	
	$\dfrac{1}{4} = a^{-2}$		
	$2^{-2} = a^{-2}$	✓ a = 2	
	$a = 2$		(2)
5.3	CD = 3 units	✓	(1)
5.4	$y \in R,\ y \geq -2$	✓	(1)
5.5.1	$-1 \leq x \leq 1$	✓	(1)
5.5.2	$x > 0$	✓	(1)
5.5.3	$x < -2$	✓	(1) [12]

QUESTION 6

6.1.1	1,00		(1)
6.1.2	7,07		(1)
6.2	$\tan^2 30°.\sec 45°$ $= \dfrac{1}{\sin^2 60°}$ $= \left(\dfrac{1}{\sqrt{3}}\right)^2\left(\dfrac{\sqrt{2}}{1}\right)$ $= \dfrac{\left(\dfrac{1}{3}\right)(\sqrt{2})}{1}$ $\dfrac{\left(\dfrac{3}{4}\right)}{1}$ $= \dfrac{\sqrt{2}}{3}\times\dfrac{3}{4}=\dfrac{\sqrt{2}}{4}$	$\checkmark \dfrac{1}{\sqrt{3}}$ $\checkmark \sqrt{2}$ $\checkmark \dfrac{\sqrt{3}}{2}$	
6.3	$(-6)^2+(-8)^2=r^2$ (Pythagorus) $36+64=r^2$ $r^2=100$ $r=10$ $\sin\theta-\cos\theta$ $=\left(-\dfrac{8}{10}\right)-\left(-\dfrac{6}{10}\right)$ $=-\dfrac{2}{10}$ $=-\dfrac{1}{5}$	$\checkmark$ answer $\checkmark$ correct quadrant $\checkmark\left(-\dfrac{8}{10}\right)$ $\checkmark\left(-\dfrac{6}{10}\right)$ $\checkmark -\dfrac{1}{5}$	(4)
6.4.1	$\sin\alpha = p$ $\cos^2\alpha$ $=\left(\dfrac{\sqrt{1-p^2}}{1}\right)^2$ $=1-p^2$	$\checkmark \sqrt{1-p^2}$ $\checkmark 1-p^2$	(2)

6.4.2	$\tan\alpha$ $=\dfrac{p}{\sqrt{1-p^2}}$	$\checkmark$	(1)
6.5.1	$\sin 2x = 0,682$ $2x = 43,001^0$ $x = 21,50°$	$\checkmark$ $\checkmark$	(2)
6.5.2	$\sin(x-40°) = 0,58$ $x-40° = 35,4505^0$ $x = 75,45°$	$\checkmark$ $\checkmark$	(2) **[17]**

QUESTION 7

7.1.1	$y = \cos x$	$\checkmark$	(1)
7.1.2	A(90°;0) B(270°;0)	$\checkmark$ $\checkmark$	(2)
7.1.3	Domain: $x\in[0°;360°]$ Range: $y\in[-1;1]$	$\checkmark$ $\checkmark$	(2)
7.1.4	Amplitude : 1 Period: 360°	$\checkmark$ $\checkmark$	(2)
7.1.5	$g(x)=-\cos x-2$	$\checkmark -\cos x$ $\checkmark -2$	(2)
7.2		f $\checkmark$ shape $\checkmark$ (0°;-1) $\checkmark$(90°;0) and (270°;-2) g $\checkmark$ shape $\checkmark$(0°;2) $\checkmark$(90°;0) and (270°;0)	(6) **[15]**
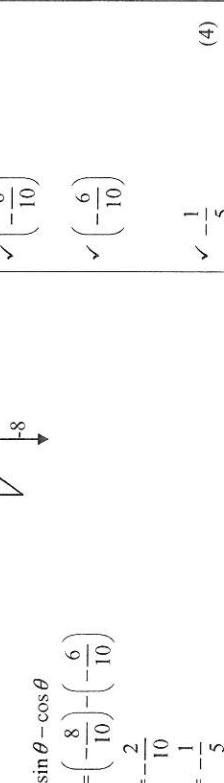
QUESTION 8

8.1.1	$a^2 = (16)^2 + (14)^2$ (Pythagoras) $a = 2\sqrt{113}\ cm$ $a = 21\ cm$	✓	(2)
8.1.2	$b = \sqrt{113}$ Mid-point Theorem $b = 10,5\ cm$	✓	(2)
8.2	$\hat{P} = 119°$ corresponding angles PS∥QR $c = 119°$ alternate angles PQ∥RS	✓ ✓	(4)
8.3.1	$\hat{A}_3 = 48°$ (angles opp equal sides) $\hat{D}_1 = 96°$ (ext. angle Δ = sum int. opp.angles)	✓ 48° & reason ✓ 96° & reason	
8.3.2	$\hat{E}_1 = 143°$ (vert.opp.angles) $\hat{B}_1 = 37°$ (co-int. angles , PQ ∥ RS)	✓ 143° & reason ✓ 37° & reason	
8.3.3	$\hat{B}_3 = 58°$ (adj.angles str.line) $\hat{A}_2 = 26°$ (sum angles Δ)	✓ 58° & reason ✓ 96° & reason	(6) [14]

TOTAL MARKS: 100