MARKING GUIDE (MARK SCHEME)

MATHEMATICS

FORM 3 CAT 1 TERM 2 2021

TIME: 1HR 30 MINS

INSTRUCTIONS

1. Electronic non-programmable calculators may be used
2. Answer all questions in the provided spaces.
3. All questions are compulsory

Q	1	2	3	4	5	6	7	8	7	8	9	10	TOTAL
TOTAL MARKS	3	3	4	3	3	3	3	3	3	3	3	6	30
MARKS OBTAINED													

1. The length and breadth of a rectangular card were measured to the nearest millimetre and found to be 14.5cm and 10.6cm respectively. Find the percentage error in the perimeter. 3mks

$\boldsymbol{Pmax = 2(14.55 + 10.65) = 50.4cm}$ $\boldsymbol{Pactual = 2(14.5 + 10.6) = 50.2cm}$ $\boldsymbol{Pmin = 2(14.45 + 10.55) = 50cm}$	B1 (All answers correct)
$\boldsymbol{absolute\ error = \frac{Pmax - Pmin}{2}}$ $\boldsymbol{= \frac{50.4 - 50}{2}}$ $\boldsymbol{= 0.2cm}$	M1 (Correct absolute error)
$\boldsymbol{\%error\ in\ Perimeter = \frac{0.2}{50.2} \times 100}$ $\boldsymbol{= 0.398\%}$	A1 (correct percentage error)

2. Simplify the following expression;

$\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$, giving your answer in the form $a + b\sqrt{c}$, where a, b and c are real numbers 3mks

$\frac{(\sqrt{3}-\sqrt{2})(\sqrt{3}-\sqrt{2})}{(\sqrt{3}+\sqrt{2})(\sqrt{3}-\sqrt{2})}$	M1 (evidence of rationalizing the denominator)
$\frac{3-2\sqrt{6}+2}{3-2}$ $\frac{5-2\sqrt{6}}{1}$	M1 (Full rationalization)
$5-2\sqrt{6}$	A1 (Answer in form of $a + b\sqrt{c}$)

3. Evaluate without using tables;

$\log(3x+8) - 3\log 2 = \log(x-4)$ 4mks

$\log\frac{3x+8}{8} = \log(x-4)$	M1 (applying laws of logs)
$\frac{3x+8}{8} = x-4$	M1 (dropping the logs)
$8(x-4) = 3x+8$ $8x-32 = 3x+8$ $8x-3x = 32+8$ $5x = 40$	M1 (Cross multiplying, removing brackets and collecting like terms)
$x = 8$	A1 (obtaining correct answer)

4. Simplify $\frac{12x^2-16x}{20-11x-3x^2}$ 3mks

$Numerator = 12x^2 - 16x$ $= 4x(3x - 4)$	M1
$Denominater = 20 - 11x - 3x^2$ $= 20 - 15x + 4x - 3x^2$ $= 5(4 - 3x) + x(4 - 3x)$ $(5 + x)(4 - 3x)$	M1
$\frac{Numerator}{Denominator} = \frac{4x(3x-4)}{(5+x)(4-3x)}$ $= \frac{-4x(3x-4)}{(5+x)(3x-4)}$ $= \frac{-4x}{5+x}$	A1

5. Solve for x in the equation:

$\frac{1}{2}\log_2 81 + \log_2(x^2 - \frac{x}{3}) = 1$ 3mks

$\log_2 9 + \log_2(x^2 - \frac{x}{3}) = \log_2 2$ $= 9\left(x^2 - \frac{x}{3}\right) = 2$	M1 (applying laws of logs)
$9x^2 - 3x = 2$ $9x^2 - 3x - 2 = 0$ $9x^2 - 6x + 3x - 2 = 0$ $3x(3x - 2) + 1(3x - 2) = 0$	M1 (Forming and factorizing quadratic equation)
$either\ (3x + 1) = 1 \Rightarrow\ x = \frac{-1}{3}$ $OR\ 3x - 2 = 0 \rightarrow x = \frac{2}{3}$	A1 (Getting correct roots)

6. A student expands $(x-y)^2$ *as* x^2-y^2, if he used the formula to evaluate $(12\text{-}9)^2$, find the percentage error in his calculation 3mks

Correct calculation $=x^2-2xy+y^2=144-216+81=9$

$$wrong\ calculation = x^2-y^2=144-81=63$$

$$error=63-9=54$$

$$\%error=\frac{54}{9}\times 100=600\%$$

7. A two-digit number is such that the sum of the ones and tens digit is ten. If the digits are reversed, the new number formed exceeds the original number by 54. Find the number. 3mks

$$x+y=10\ldots(i)$$

$$10y+x-(10x+y)=54$$

$$10y-y+x-10x=9y-9x=54$$

$$y-x=6\ldots(ii)$$

Combining

$$\begin{array}{r} x+y=10 \\ -x+y=6 \quad + \\ \hline 2y=4 \end{array}$$

$$y=2$$

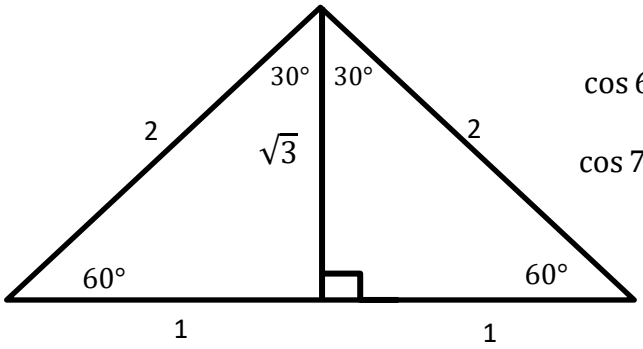
$$x+y=10\rightarrow x=10-2=8$$

8. Simplify without using tables or a calculator ; $\dfrac{\sin 480°-\cos 765°}{tan225°-\cos\ (-330°)}$ 3mks

$\sin 480° = \sin(480 - 360) = \sin 120°$ $120°$ Falls in 2nd quadrant hence Sine is +ve

$$\sin 120° = \sin(180° - 120°) = \sin 60°$$

Using equilateral triangle of side 2 units:

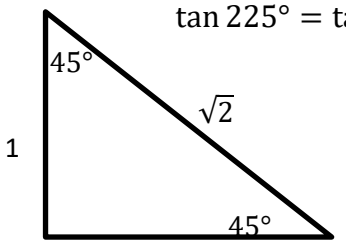


$\cos 60° = \frac{1}{2}$

$\cos 765 = \cos 45$ +ve falls in first quadrant

$$Cos\ 45 = \frac{1}{\sqrt{2}}$$

$\tan 225° = \tan(225° - 180°) = \tan 45°$(3rd quadrant tangent +ve)



$\tan 45 = \frac{1}{1} = 1$

$\cos(-330) = \cos 30 = \frac{\sqrt{3}}{2}$

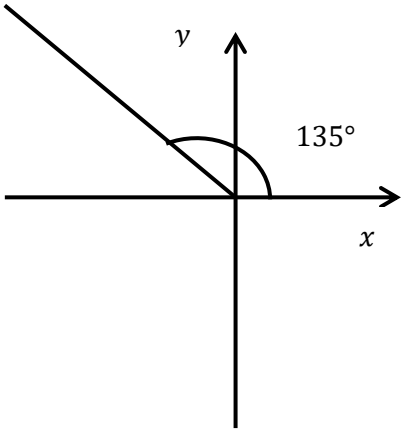
$\frac{\frac{1}{2}-\frac{1}{\sqrt{2}}}{1-\frac{\sqrt{3}}{2}} = \frac{\frac{1}{}}{\frac{2-\sqrt{3}}{2}} = \frac{\sqrt{2}-2}{2\sqrt{2}(2-\sqrt{3})} = \frac{\sqrt{2}-2}{4\sqrt{2}-2\sqrt{6}}$

$$\frac{(\sqrt{2}-2)(4\sqrt{2}+2\sqrt{6})}{(4\sqrt{2}-2\sqrt{6})(4\sqrt{2}+2\sqrt{6})}$$

$$= \frac{8+4\sqrt{3}-4\sqrt{2}-4\sqrt{6}}{32-24}$$

$$= 1+\frac{\sqrt{3}}{2}-\frac{\sqrt{2}}{2}-\frac{\sqrt{6}}{2}$$

9. A line parallel to line OP shown in figure below cuts the y-axis at $(0, -1)$. Find the equation of the line: 3mks



$\tan 45° = -1$

$m = -1$

$\frac{-1 - y}{0 - x} = -1$

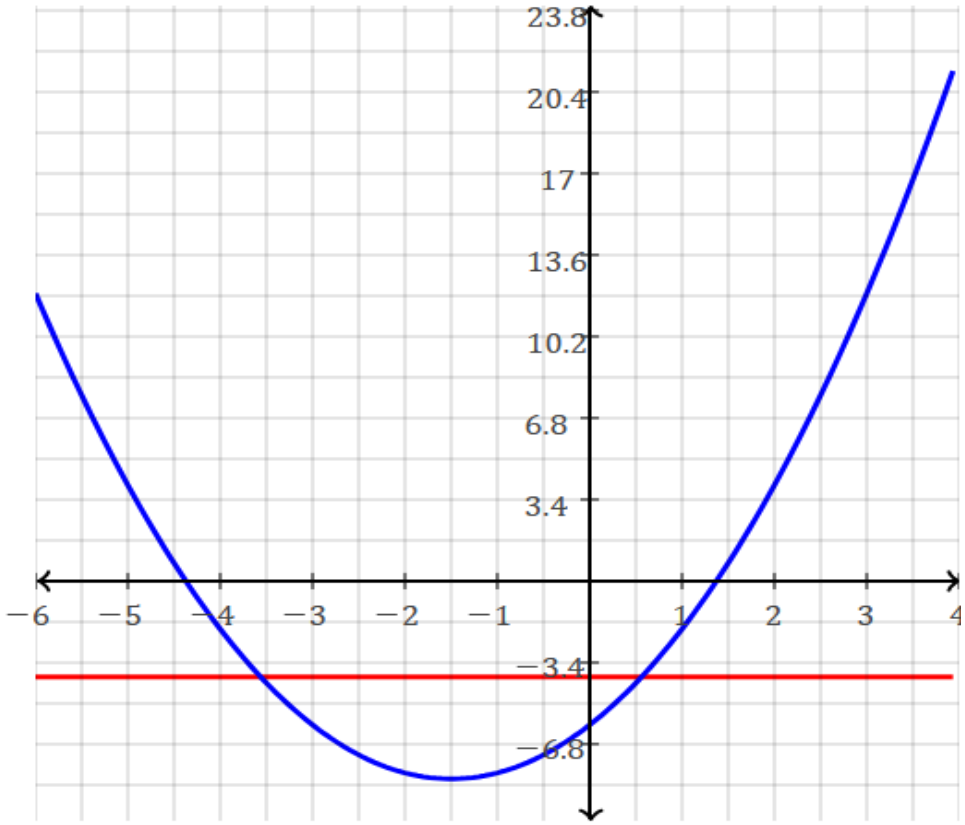
$x = -1 - y$

$y = -x - 1$

10. (a) Complete the table below for the equation $y = x^2 + 3x - 6$, given $-6 \leq x \leq 4$. 1mk

x	-6	-5	-4	-3	-2	-1	0	1	2	3	4
y	12	**1**	**-2**	-6	**-8**	**-8**	-6	**-2**	**4**	**12**	22

b) Using a scale of $1cm$ to represent 2 units in both axes, draw the graph of $y = x^2 + 3x - 6$ (2mks)



c) Use the graph to solve the quadratic equations:

(i) $x^2 + 3x - 6 = 0$ (1mks)

(1.37, 0), **(-4.38,** 0)

$$x = 1.4 \; or \; x = -4.4$$

(ii) $x^2 + 3x - 2 = 0$ (2mks)

$$y = x^2 + 3x - 6$$
$$0 = x^2 + 3x - 2$$
$$y = -4$$
$$X = -3.4 \; or \; x = -0.5$$