Name: **MARKING SCHEME** .... ADM No:............. Date:............

FORM 3

MATHEMATICS

Time: 2 Hours

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MATHEMATICS

Time: 2 Hours

Instructions To Candidates

Write your name, class and admission number in the space provided at the top of this page.

This paper has two sections: Section I and Section II

Answer all questions in section I and any three questions in section II

All answers and working must be written on the question paper in the spaces provided below each question.

Show all the steps in your calculations, giving your answer at each stage in the space below each question.

Marks may be awarded for correct working even if the answer is wrong.

Non-Programmable silent electronic calculators and KNEC Mathematical Tables may be used except where stated otherwise.

For examiners use only

GRAND TOTAL.

SECTION I (40MKS)

(Answer all questions from this section)

1. Use logarithms to evaluate (3mks)

$$\frac{4.73 \times 22.41}{82.3}$$

No	std form	Log
4.73	4.73×10^0	0.6749
22.41	2.241×10^1	1.3504 +
		2.0253
82.3	8.23×10^1	1.9164 −
		0.1099
1.288	1.288×10^0	

2. Solve for x in $\log_3 81 = x$ (3mks)

$$3^x = 81$$
$$3^x = 3^4$$
$$x = 4$$

81
3 ⟋ 27 3^4
3 ⟋ 9
3 ⟋ 3
3   3

3. Use tables of cubes and reciprocals to evaluate (4mks)

$$\sqrt{0.498} + \frac{0.1}{0.0351}$$

$$\left(49.8 \times \frac{1}{100}\right)^{\frac{1}{2}} + \frac{1}{0.351}$$

$$7.0569 \times \frac{1}{10} + \frac{1}{3.51} \times \frac{1}{10^{-1}}$$

$$0.70569 + 0.2849 \times 10$$

$$0.70569 + 2.849$$

$$= 3.55469$$

4. When a number is divided by 8, 9 and 6 the remainders are 7, 8 and 5 respectively. Find the number. (3mks)

Let the number be N

$\frac{N}{8}$, rem = 7

$\frac{N}{9}$, rem = 8

$\frac{N}{6}$, rem 5

N is given by the L.c.m of 8,9, and 6 and subtracting 1 from it.

2	8	9	6
3	4	9	3
2	2	9	3
3	1	9	3
3	1	3	
	1	1	

$2^3 \times 3^2 = 72$

$N = 72 - 1$

$= 71$

5. A line with gradient -3 passes through (3, k) and (k, 8). Find the value of k and hence the equation of the line, where a, b and e are constants. (4mks)

$\frac{8-K}{K-3} = \frac{-3}{1}$

$8 - K = -3K + 9$

$3K - K = 9 - 8$

$2K = 1$

$K = \frac{1}{2}$ or 0.5

$\frac{y - \frac{1}{2}}{X - 3} = \frac{-3}{1}$

$y - \frac{1}{2} = -3X + 9$

$2y - 1 = -6X + 18$

$2y = -6x + 19$

$y = -3x + \frac{19}{2}$

6. In a fundraising committee of 45 people, the ratio of men to women is 7: 2. Find the number of women required to join the committee so that the ratio of men to women is changed to 5: 4. (3mks).

let # of women joining be x

Initial # of men
$= \frac{7}{9} \times 45 = 35$

Initial # of women
$= \frac{2}{9} \times 45 = 10$

After x women joined, the ratio changed to 5:4

$\frac{35}{10 + x} = \frac{5}{4}$

$50 + 5x = 140$

$5x = 90$

$x = \frac{90}{5}$

$x = 18$ women.

7. The marked price of a car in a dealer's shop was Ksh. 450 000. Simiyu bought the car at 7% discount. The dealer still made a profit of 13%. Calculate the amount of money the dealer had paid for the car to the nearest thousands. (4mks)

$$\frac{93}{100} \times 450\,000$$

$$= 418\,500\,/.$$

$$113\% = 418\,500$$

$$100\% = ?$$

$$\frac{100 \times 418\,500}{113}$$

$$= sh.\ 370\,000$$

8. The size of an interior angle of a regular polygon is $3x^0$ while that of exterior is $(x-20)^0$. Find the number of sides of the polygon. (3mks)

$$3x^\circ + (x-20)^\circ = 180^\circ$$

$$4x = 180 + 20$$

$$4x = 200^\circ$$

$$x = 50^\circ$$

Size of exterior angle
$$= 50^\circ - 20^\circ = 30^\circ$$

No. of sides of polygon
$$\frac{360^\circ}{30} = 12\ sides$$

9. The GCD and LCM of three numbers are 3 and 1008 respectively. If two of the numbers are 48 and 72, find the least possible value of the third number. (3mks)

$$G.C.D = 3$$

$$L.C.M = 1008$$
$$= 2^4 \times 3^2 \times 7$$

1st No: $48 = 2^4 \times 3$

2nd No: $72 = 2^2 \times 3^2$

3rd No: $= 3 \times 7$
$$= 21$$

or

3rd No $= 3^2 \times 7$
$$= 63$$

Least possible #
$$- 21$$

10. A straight line through A(2, 1) and B(4, m) is perpendicular to the line whose equation is $3y = 5 - 2x$. Determine the value of m. (3mks)

$$3y = 5 - 2x$$
$$y = -\frac{2}{3}x + \frac{5}{3}$$

For $\perp$ lines, $M_1 M_2 = -1$

$$M_2 = -\frac{2}{3}$$
$$M_1 = \frac{3}{2}$$

$$\frac{m-1}{4-2} = \frac{3}{2}$$
$$2m - 2 = 6$$
$$2m = 8$$
$$m = 4$$

11. Two similar solids have surface areas of 48cm² and 108cm² respectively. Find the volume of the smaller solid if the bigger one has a volume of 162cm³. (3mks)

$$A.S.F. = \frac{108}{48} = \frac{9}{4}$$

$$L.S.F. = \sqrt{\frac{9}{4}} = \frac{3}{2}$$

$$V.S.F. = (L.S.F)^3$$
$$= \left(\frac{3}{2}\right)^3$$
$$= \frac{27}{8}$$

$$\frac{27}{8} = \frac{162}{x}$$

$$x = \frac{162 \times 8}{27}$$

$$x = 48 \, cm^3$$

12. Given that $\cos(x - 20)° = \sin(2x + 32)°$ and that x is an acute angle, find $\tan(x - 4)°$ (4mks)

$$(x - 20)° + (2x + 32)° = 90$$

$$3x = 78$$

$$x = \frac{78}{3} = 26°$$

$$\tan(x - 4)° = \tan(26 - 4)°$$
$$= \tan 22°$$
$$= 0.4040$$

SECTION II (30MKS)

(Answer any 3 questions from this section)

13. The coordinates of a triangle ABC are   A(1, 1)   B(3, 1)   and   C(1, 3),

    (a) Plot the triangle ABC.   (1 mark)

    (b) Triangle ABC undergoes a translation vector $\binom{2}{2}$. Obtain the image of A' B'

    C' under the transformation, write the coordinates of A' B' C'.   (2 marks)

$$OA' = \binom{1}{1} + \binom{2}{2} = \binom{3}{3} \Rightarrow A'(3, 3) \qquad OC' = \binom{1}{3} + \binom{2}{2} = \binom{3}{5}$$

$$OB' = \binom{3}{1} + \binom{2}{2} = \binom{5}{3} \Rightarrow B'(5, 3) \qquad C'(3, 5)$$

    (c) A' B' C' undergoes a reflection along the line X = 0, obtain the coordinates and

        plot on the graph points A" B" C", under the transformation   (2 marks)

$$A''(-3, 3) \qquad B''(-5, 3) \qquad C''(-3, 5)$$

    (d) The triangle A" B" C" , undergoes an enlargement scale factor -1, centre

        origin.   Obtain the coordinates of the image A''' B''' C'''.   (2 marks)

$$A'''(3, -3) \qquad C'''(3, -5)$$

$$B'''(5, -3)$$

    (e) The triangle A''' B''' C''' undergoes a rotation centre (1, -2) angle 120^0. Obtain

        the coordinates of the image A" B^{iv} C^{iv}.   (2 marks)

$$A^{iv}(0.9, 0.4) \qquad B^{iv}(0, 2.1) \qquad C^{iv}(2.6, 1.3)$$

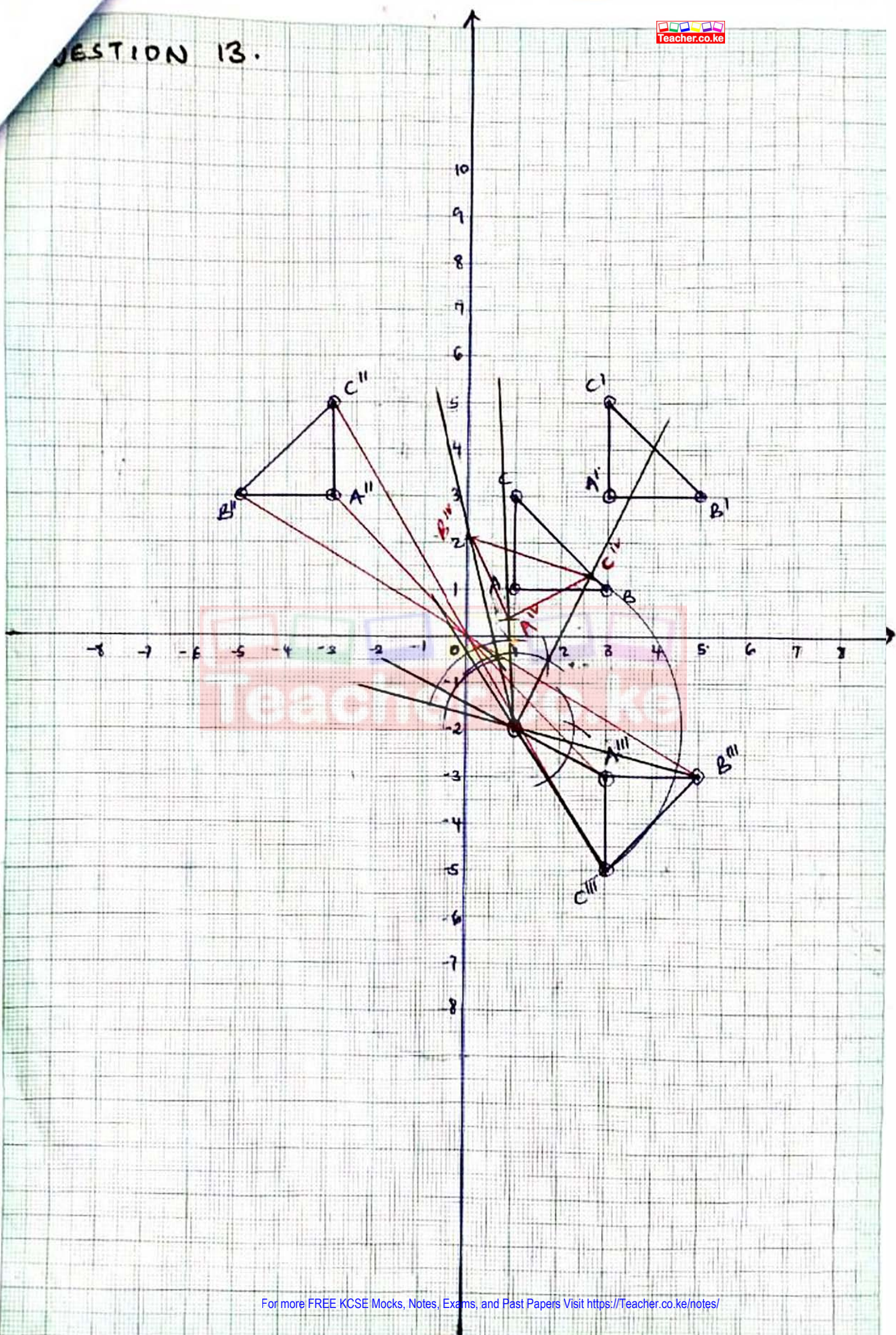   (f) Which triangles are directly congruent.   (1 mark)

$$A B C \quad and \quad A'B'C'$$

$$A''' B''' C''' \quad and \quad A^{iv}B^{iv}C^{iv}$$

14. A country bus left town A at 11:45 am and travelled towards town B at an average speed of 60km/hr. A matatu left town B at 1:15 pm on the same day and travelled towards town A along the same road at an average speed of 90km/hr. The distance between the two towns is 540 km. Determine:

(a) The time of the day the two vehicles met.   (4marks)

540 Km → B

11:45 am

Bus ⟶ 60 km/h   90km/h Matatu   1:15 pm

```
 1315
-1145
──────
  1.30
```
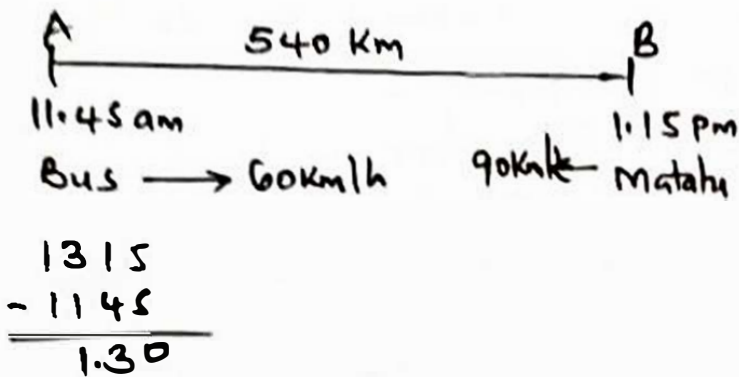
Distance travelled by bus:

$60 \times 1.5 = 90 \text{ Km}$

Distance left = $540 - 90$
         $= 450 \text{ Km}$

R. speed = $90 + 60 = 150 \text{ km/h}$

Time taken to meet:
$$\frac{450}{150} = 3 \text{ hrs}$$

Time of the day of meeting:
```
  1.15
+ 3.00
──────
  4.15 pm
```

(b) How far from town A they met.   (2marks)

Bus distance from 1:15pm

$= 60 \text{ Km/h} \times 3 \text{ hours}$

$= 180 \text{ Km}$

Distance from A:

$90 + 180 = \underline{\underline{270 \text{ Km}}}$

(c) How far from town B the bus was when the matatu reached town A   (4marks)

Time taken by matatu

$$\frac{540 \text{ Km}}{90 \text{ Km/h}} = 6 \text{ hours}$$

Distance travelled by bus from 1:15 pm

$= 450 \text{ Km}$

Distance covered in 6hrs:

$60 \text{ Km/h} \times 6 = 360 \text{ Km}$

Total Distance covered by Bus:

Distance of Bus from B when Matatu reached A

$450 \text{ Km} - 360 \text{ Km}$

$= 90 \text{ Km}$

15. The table below shows the mass to the nearest gram, of 101 mango seeds in a research station.

Mass(gram)	10 -14	15 -19	20 - 24	25 - 29	30 -34	35 – 39
Frequency	2	14	33	35	14	3

(a) State the modal class. (1mark)

$$25 - 29$$

(b) Calculate to 2 decimal places:
  (i). The mean mass (4marks)

Mass	midpoint x	f	c.f.	fx
10 -14	12	2	2	24
15 -19	17	14	16	238
20-24	22	33	49	726
25-29	27	35	84	945
30-34	32	14	98	448
35 -39	37	3	101	111
		Σf=101		Σfx= 2492

$$\text{Mean, } \bar{X} = \frac{\Sigma fx}{\Sigma f}$$

$$= \frac{2492}{101}$$

$$= 24.67 \text{ g}$$

(ii). The difference between the median mass and the mean mass. (5marks)

$$\text{median} = 24.5 + \left(\frac{2}{35}\right)5$$

$$= 24.5 + 0.2857$$
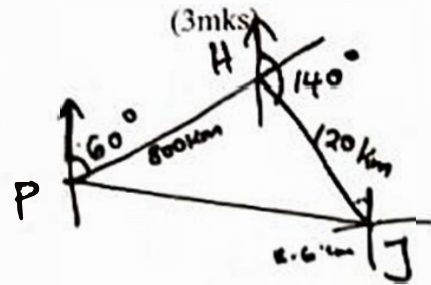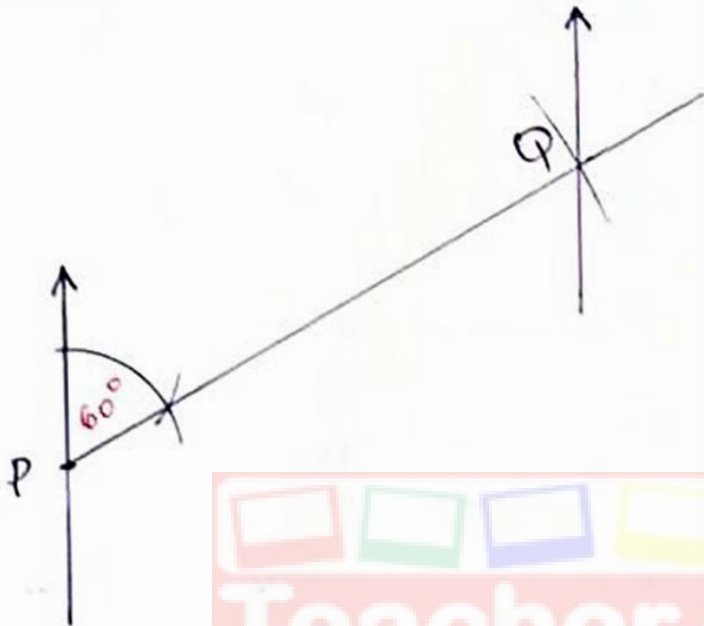
$$= 24.7857 \text{ g}$$

$$\simeq 24.79 \text{ g}$$

$$\text{Difference} = 24.79 - 24.67$$

$$= 0.12 \text{ g}$$

16. A helicopter is stationed at an airport H on a bearing of 060° and 800km from another airport P. A third airport J is on a bearing of 140° and 120km from H.

    a. Using a scale of 1cm represents 100km;

        i. Show the relative positions of P, H and J

(3mks)

ii. Determine the distance between P and J   (2mks) 8.7 ± 0.1

iii. State the bearing of P from J   (2mks) 267°

(b) A jet flying at a speed of 103km/h left J towards P. The helicopter at H also took off towards P at the same time. Find the speed at which the helicopter will fly so as to arrive at P 12 minutes later than the jet.   (3mks)

17. Given that $y = 2x^2 + 3x - 7$ for $-4 \leq x \leq 3$

    a. Complete the table below   (2mks)

x	-4	-3	-2	-1	0	1	2	3
$2x^2$	32	18	8	2	0	2	8	18
3x	-12	-9	-6	-3	0	3	6	9
-7	-7	-7	-7	-7	-7	-7	-7	-7
y	13	4	-5	-8	-7	-2	7	20

    b. Draw the graph $y = 2x^2 + 3x - 7$ for $-4 \leq x \leq 3$ (3mks)

    c. Use the graph to find the roots of the equation

        i. $2x^2 + 3x - 7 = 0$ (2mks)

$$y = 2x^2 + 3x - 7$$
$$0 = 2x^2 + 3x - 7$$

$$x = -2.60 \text{ or } x = 1.25$$

$$y = 0$$

        ii. $2x^2 + 4x - 9 = 0$ (3mks)

$$y = 2x^2 + 3x - 7$$
$$- \quad 0 = 2x^2 + 4x - 9$$
$$\overline{}$$
$$y = \quad\quad -x + 2$$

x	0	2	-4
y	2	0	6

$$x = -3.2 \quad \text{or} \quad x = 1.3$$

QUESTION 17.

$y = 2x^2 + 3x - 7$

$y = -x + 2$