Answer all TWENTY TWO questions.
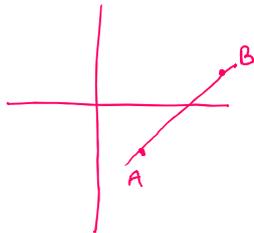
Write your answers in the spaces provided.

You must write down all the stages in your working.

1   The point A has coordinates $(5, -4)$
    The point B has coordinates $(13, 1)$

    (a) Work out the coordinates of the midpoint of AB.

$5+13=18$

$18/2 = 9$

$-4+1 = -3$

$-3/2 = -1.5$

$(\underline{\quad 9 \quad}, \underline{\quad -1.5 \quad})$

(2)

Line **L** has equation $y = 2 - 3x$

(b) Write down the gradient of line **L**.

$y = mx + c$

$y = -3x + 2$

$m = $ gradient

$\underline{\quad -3 \quad}$

(1)

Line **L** has equation $y = 2 - 3x$

(c) Does the point with coordinates $(100, -302)$ lie on line **L**?
    You must give a reason for your answer.

$y = 2 - 3x$

$y = 2 - 3(100)$

$y = -298$

$(100, -298)$ is on the line so $(100, -302)$ is not
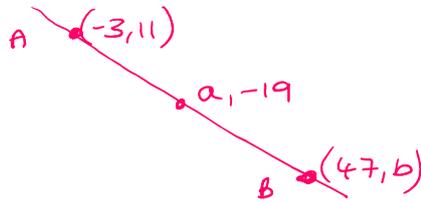
(1)

(Total for Question 1 is 4 marks)

Algebra Page 1

6   Point A has coordinates $(-3, 11)$
    Point B has coordinates $(47, b)$
    The midpoint of AB has coordinates $(a, -19)$

    Find the value of a and the value of b.

Change in x $-3 \rightarrow 47 = 50$

$\frac{50}{2} = 25$

$-3 + 25 = 22$

Change in y $11 \rightarrow -19 = 30$

$-19 - 30 = -49$

$a = \underline{22}$

$b = \underline{-49}$

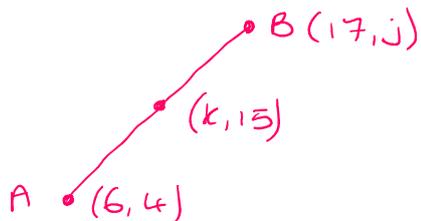**(Total for Question 6 is 2 marks)**

Algebra Page 2

6 The points A and B are on a coordinate grid.

The coordinates of A are $(6, 4)$
The coordinates of B are $(17, j)$ where j is a constant.

The midpoint of AB has coordinates $(k, 15)$ where k is a constant.

Find the value of j and the value of k

Handwritten annotations:

B (17, j)

(k, 15)

A (6, 4)

Change in y
$4 \rightarrow 15 = 11$
$15 + 11 = 26$

Change in x
$6 \rightarrow 17 = 11$
$\frac{11}{2} = 5.5$

$6 + 5.5$

$j = \underline{11.5}$

$k = \underline{26}$

(Total for Question 6 is 3 marks)

22 Triangle *HJK* is isosceles with *HJ = HK* and *JK* = $\sqrt{80}$

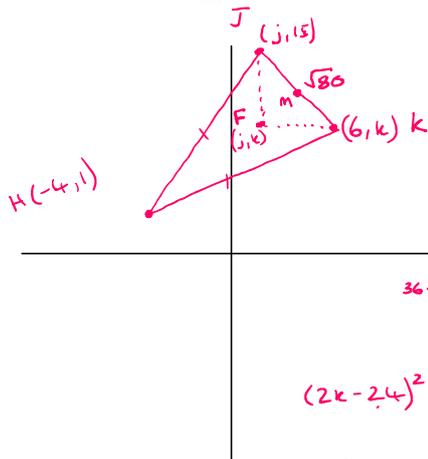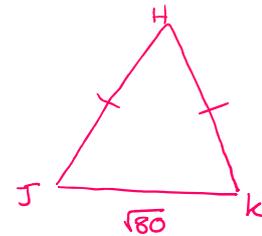*H* is the point with coordinates (−4, 1)
J is the point with coordinates (*j*, 15) where *j* < 0
K is the point with coordinates (6, *k*)

M is the midpoint of *JK*.
The gradient of *HM* is 2

Find the value of *j* and the value of *k*.

Gradient of Hm = 2

Gradient of Jk = $-\frac{1}{2}$ (Jk) $\frac{k-15}{6-j} = \frac{-1}{2}$

$2(k-15) = -(6-j)$
$2k-30 = -6+j$
$2k-24 = j$

$a^2 + b^2 = c^2$

$Fk^2 + FJ^2 = Jk^2$
$(6-j)^2 + (15-k)^2 = (\sqrt{80})^2$

$36-12j+j^2 + 225-30k+k^2 = 80$
$j^2-12j + k^2-30k + 181 = 0$

$(2k-24)^2 - 12(2k-24) + k^2 - 30k +181$

$4k^2 - 96k + 576 - 24k + 288 + k^2 - 30k + 181$

$5k^2 - 150k + 1045$

$k^2 - 30k + 209$

$(k-11)(k-19)$

$k=11$ $k=19$

$j = 2k - 24$ $j = 2(19) - 24)$
$= 2(11) - 24$ $= 14$
-2 but $j < 0$

↑

$k=11$ $j = -2$

j = ...−2........

k = ...11........

(Total for Question 22 is 6 marks)

Algebra Page 4