

Activity 3

Below are the properties that determine 'demand' and define a 'problem'.

- A.** There is little or no scaffolding: little guidance given to the student beyond a start point and a finish point. Questions do not explicitly state the mathematical process(es) required for the solution.
- B.** There is a need for multiple representations, such as the use of a sketch or a diagram as well as calculations.
- C.** The information is not given in mathematical form or in mathematical language; or there is a need for the results to be interpreted or methods evaluated, for example, in a real-world context.
- D.** There is a variety of techniques that could be used.
- E.** The solution requires understanding of the processes involved rather than just application of the techniques.

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- 1.** the complexity of elements of knowledge or task - linked to the expectation of the content standards of the qualification level
- 2.** the number of steps/linkages involved in a response
- 3.** the level of familiarity/prior knowledge students may have on the content or procedures required; the procedure is routine and does not require any adaptation or application
- 4.** the predictability of a question - from series to series - how familiar the question is over time

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 .

The correct values are $j = -2$ and $k = 11$.

22	gradient of $JK = -0.5$ or $m \times 2 = -1$	M1 for finding the gradient of JK using $m_1 \times m_2 = -1$
	$\frac{k-15}{6-j} = -\frac{1}{2}$ or $2k-j = 24$ or $j = 2k-24$ or $k = \frac{j+24}{2}$ oe	M1 for expressing the gradient of JK in terms of j and k or a correct equivalent equation
	$(j-6)^2 + (k-15)^2 = 80$ oe or $\left(\frac{j+6}{2}, \frac{k+15}{2}\right)$ oe or $(j+4)^2 + 196 = 100 + (k-1)^2$ oe	M1 for finding equation of JK in terms of j and k or for finding the midpoint of M or for equating length HJ with length HK
	eg $3k^2 - 78k + 495 = 0$ oe or $5j^2 - 60j - 140 = 0$ oe or $5k^2 - 150k + 1045 = 0$ oe or $3j^2 - 12j - 36 = 0$ oe or gradient HM : eg $\frac{\frac{k+15}{2}-1}{\frac{j+6}{2}+4} = 2$ or $k = 2j+15$ or $j = \frac{k-15}{2}$ oe	M1 (dep on M3) writing a correct quadratic expression in the form $ax^2 + bx + c (=0)$ (allow $ax^2 + bx = c$) or A correct equation for the gradient of HM in terms of j and k or a correct equivalent equation
	eg $(k-15)(k-11) (=0)$ or $\frac{78 \pm \sqrt{(-78)^2 - 4 \times 3 \times 495}}{2 \times 3}$ or $(k-13)^2 - 169 + 165(-0)$	eg $(j-6)(j+2) (=0)$ or $\frac{12 \pm \sqrt{(-12)^2 - 4 \times 3 \times -36}}{2 \times 3}$ or $(j-2)^2 - 4 - 12(-0)$
		M1 (dep on M3) for a complete method to solve their 3-term quadratic equation (allow one sign error in the use of the quadratic formula) or a correct method to eliminate either j or k eg $2k-24 = \frac{k-15}{2}$ oe or $\frac{j+24}{2} = 2j+15$ oe
		A1
		Total 6 marks

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22	$\left(\frac{j+6}{2}, \frac{k+15}{2}\right)$ oe	M1 for finding the midpoint of M
ALT	$\frac{\frac{k+15}{2}-1}{\frac{j+6}{2}+4} = 2$ or $k-2j = 15$ or $k = 2j + 15$ or $j = \frac{k-15}{2}$ oe	M1 for expressing the gradient of JK in terms of j and k or a correct equivalent equation
	$(j-6)^2 + (k-15)^2 = 80$ oe or $(j+4)^2 + 196 = 100 + (k-1)^2$ oe	M1 for finding the length of JK in terms of j and k or for equating length HJ with length HK
	E.g. $5j^2 - 12j - 44 = 0$ or $3j^2 + 48j + 84 = 0$ oe	E.g. $5k^2 - 174k + 1309 = 0$ or $3k^2 + 6k - 429 = 0$ oe allow $ax^2 + bx = c$
	E.g. $(5j-22)(j+2) (= 0)$ or $\frac{12 \pm \sqrt{(-12)^2 - 4 \times 5 \times -44}}{2 \times 5}$ or $(j+8)^2 - 64 + 28 (= 0)$	E.g. $(5k-119)(k-11) (= 0)$ or $\frac{174 \pm \sqrt{(-174)^2 - 4 \times 5 \times 1309}}{2 \times 5}$ or $(k+1)^2 - 1 - 143 (= 0)$ M1 (dep on M3) for a complete method to solve their 3-term quadratic equation (allow one sign error in the use of the quadratic formula)