Intersecting, Parallel or Skew Lines

Specification: AQA 7366/7367: F1 · Edexcel 9FM0: Core Pure 6.5

HOMEWORK Consolidation

1 l_1: $\mathbf{r} = \begin{pmatrix}3\\1\\-2\end{pmatrix} + \lambda\begin{pmatrix}1\\-2\\1\end{pmatrix}$ and l_2: $\mathbf{r} = \begin{pmatrix}0\\2\\-3\end{pmatrix} + \mu\begin{pmatrix}2\\1\\0\end{pmatrix}$.
Show that they intersect, and find the point.
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2 l_1: $\mathbf{r} = \begin{pmatrix}2\\-1\\1\end{pmatrix} + \lambda\begin{pmatrix}3\\1\\-1\end{pmatrix}$ and l_2: $\mathbf{r} = \begin{pmatrix}3\\-4\\1\end{pmatrix} + \mu\begin{pmatrix}1\\2\\1\end{pmatrix}$.
Intersect or skew? If they meet, find the point.
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3 l_1: $\mathbf{r} = (2\mathbf{j} + \mathbf{k}) + \lambda(\mathbf{i} + \mathbf{j} - \mathbf{k})$ and
l_2: $\mathbf{r} = (4\mathbf{i} + 5\mathbf{j}) + \mu(\mathbf{i} + 2\mathbf{k})$.
Show that they intersect, and find the point.
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4 l_1: $\frac{x+1}{2} = 3 - y = \frac{z-2}{3}$ and l_2: $\mathbf{r} = \begin{pmatrix}-1\\0\\3\end{pmatrix} + \mu\begin{pmatrix}1\\1\\1\end{pmatrix}$.
Show that the lines intersect, and find the point of intersection.
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5 l_1: $x - 2 = \frac{y+1}{3} = \frac{z-4}{-2}$ and l_2: $\mathbf{r} = \begin{pmatrix}0\\-7\\8\end{pmatrix} + \mu\begin{pmatrix}-2\\-6\\4\end{pmatrix}$.
Show that these equations describe the same line.
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6 l_1: $\mathbf{r} = \begin{pmatrix}1\\0\\4\end{pmatrix} + \lambda\begin{pmatrix}1\\-2\\1\end{pmatrix}$ and l_2: $\mathbf{r} = \begin{pmatrix}2\\1\\0\end{pmatrix} + \mu\begin{pmatrix}-3\\6\\-3\end{pmatrix}$.
Parallel, the same line, intersecting or skew?
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7 The lines l_1: $\mathbf{r} = \begin{pmatrix}1\\-1\\2\end{pmatrix} + \lambda\begin{pmatrix}1\\2\\-1\end{pmatrix}$ and
l_2: $\mathbf{r} = \begin{pmatrix}k\\0\\3\end{pmatrix} + \mu\begin{pmatrix}3\\1\\-2\end{pmatrix}$ intersect. Find k and the point of intersection.
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8 l_1: $\mathbf{r} = \begin{pmatrix}1\\2\\-1\end{pmatrix} + \lambda\begin{pmatrix}2\\-2\\1\end{pmatrix}$ and l_2: $\mathbf{r} = \begin{pmatrix}0\\0\\-4\end{pmatrix} + \mu\begin{pmatrix}3\\0\\4\end{pmatrix}$.
(a) Show that the lines intersect, and find the point.
(b) Find the acute angle between them.
AQA F1, F4 · Edexcel CP 6.3, 6.5

9 Determine whether the line $\mathbf{r} = \begin{pmatrix}-1\\6\\-4\end{pmatrix} + \lambda\begin{pmatrix}1\\-2\\2\end{pmatrix}$
meets the x-axis.
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10 l_1: $\mathbf{r} = \begin{pmatrix}1\\2\\0\end{pmatrix} + \lambda\begin{pmatrix}3\\-1\\2\end{pmatrix}$ and l_2: $\mathbf{r} = \begin{pmatrix}4\\0\\1\end{pmatrix} + \mu\begin{pmatrix}a\\2\\-4\end{pmatrix}$.
(a) Find a so that l_1 and l_2 are parallel.
(b) For this a, show that they are not the same line.
AQA 7366/7367 F1 · Edexcel CP 6.5

11 *AQA-style*. The points A and B have coordinates $(1, 2, -1)$ and $(3, 1, 1)$ respectively. The line l has Cartesian equation $x - 6 = y - 1 = 2 - z$.
(a) Find a vector equation of the line AB. [2 marks]
(b) Show that the line AB intersects l, and find the coordinates of the point of intersection. [5 marks]
AQA 7366/7367 F1 · Edexcel CP 6.5 · AQA-style

12 *Edexcel-style*. The lines l_1 and l_2 have equations
l_1: $\mathbf{r} = (2\mathbf{i} - \mathbf{j} + 3\mathbf{k}) + \lambda(\mathbf{i} + 2\mathbf{j} - \mathbf{k})$
l_2: $\mathbf{r} = (p\mathbf{i} + 4\mathbf{j} + 2\mathbf{k}) + \mu(2\mathbf{i} + \mathbf{j} + \mathbf{k})$
where p is a constant. Given that l_1 and l_2 intersect,
(a) find the value of p. (3)
(b) Find the position vector of the point of intersection. (1)
(c) Find the acute angle between l_1 and l_2. (2)
AQA F1, F4 · Edexcel CP 6.3, 6.5 · Edexcel-style