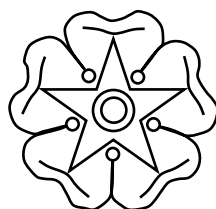
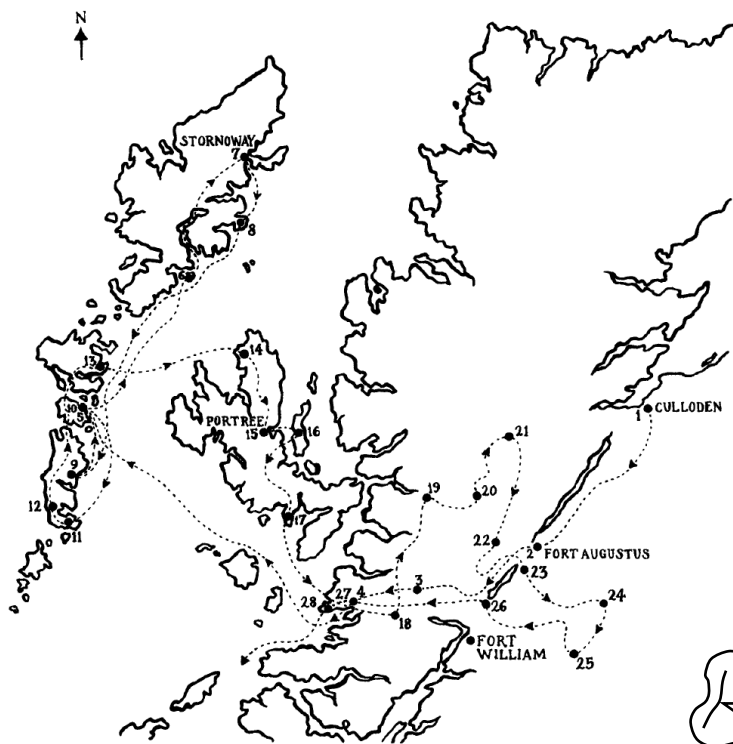
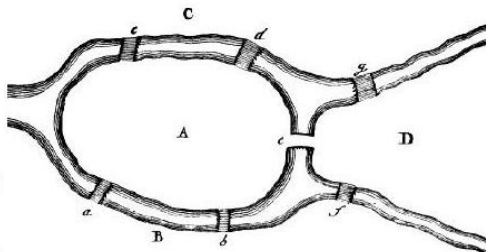


Jacobite and 18th Century Mathematics



GEORGE
WATSON'S
— COLLEGE —

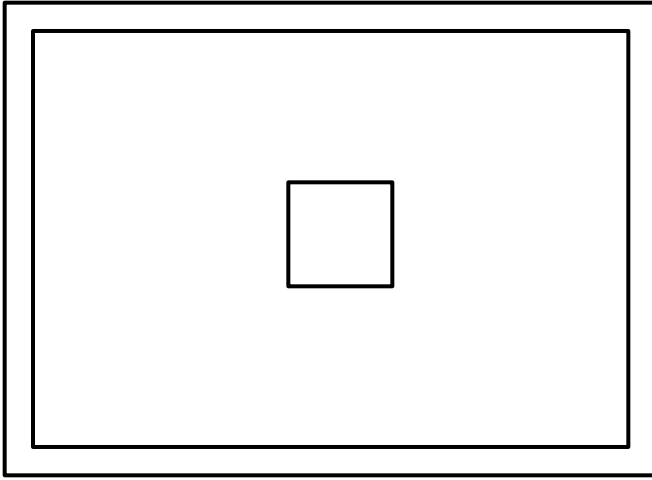
Name: _____

Jacobite Flags and Banners

Date: _____

• I can illustrate lines of symmetry (MTH 2-19a)

1. Colour the flags and banners and mark on any lines of symmetry in green.

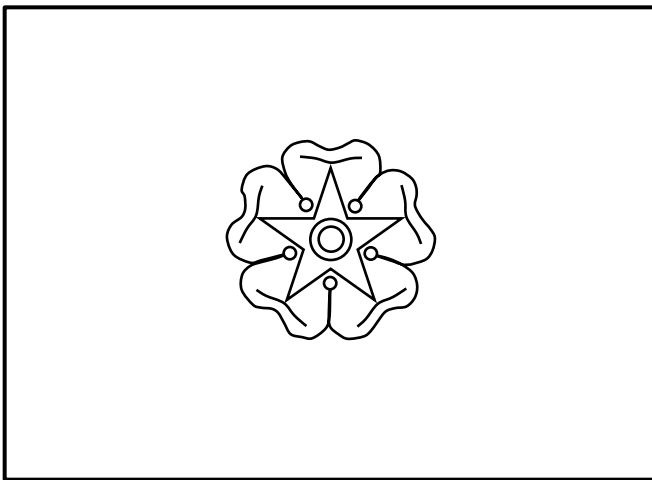


a. **Jacobite Flag, 1715 Rebellion**

Red flag with blue edging. The square in the middle is white.

Lines of symmetry _____

Degrees of rotational symmetry _____

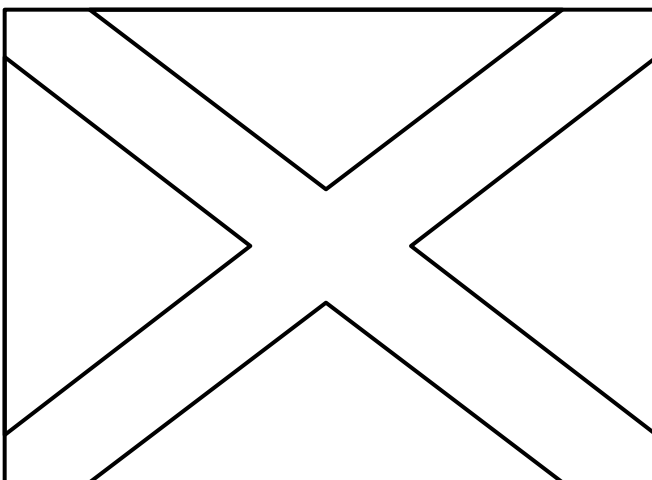


b. **Jacobite Flag, White Rose, 1715-1746**

Red flag with white rose.

Lines of symmetry _____

Degrees of rotational symmetry _____



c. **The ensign of the Appin Stuarts, 1746**

Gold saltire on blue background.

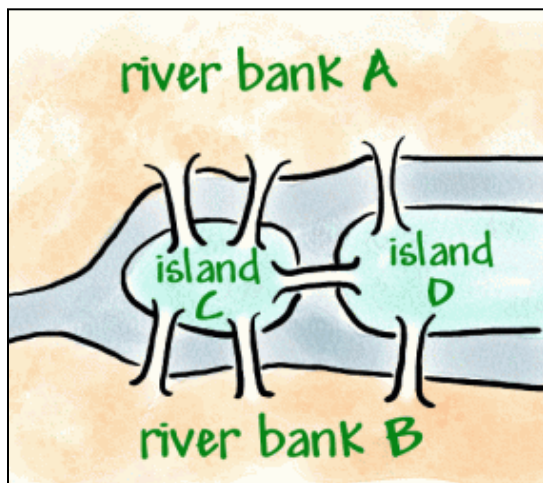
Lines of symmetry _____

Degrees of rotational symmetry _____

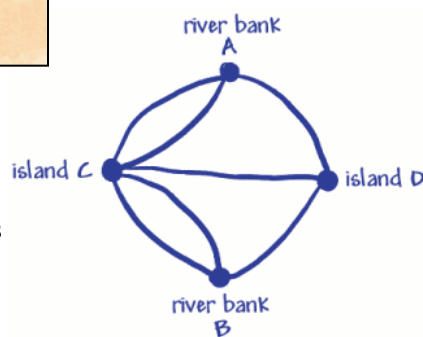
The Königsberg Bridge Problem (1736)

- I can describe how maths from the 18th century is used today (MTH 2-12a)

Königsberg is a town on the Preger River, which in the 18th century was a German town, but now is Russian. Within the town are two river islands that are connected to the banks with seven bridges (as shown below).

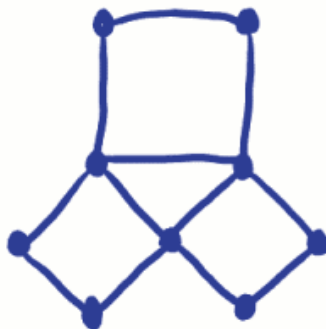


It became a tradition to try to walk around the town in a way that only crossed each bridge once, but it proved to be a difficult problem. Leonhard Euler, a Swiss mathematician, heard about the problem. In 1736 Euler proved that the walk was not possible to do. He proved this by inventing a kind of diagram called a network, that is made up of vertices (dots where lines meet) and arcs (lines).



He used four dots (vertices) for the two riverbanks and the two islands. These have been marked A, B and C, D. The seven lines (arcs) are the seven bridges. You can see that 3 bridges (arcs) join to riverbank A, and 3 join to riverbank B. 5 bridges (arcs) join to island C, and 3 join to island D. This means that all the vertices have an odd number of arcs, so they are called odd vertices. (An even vertex would have to have an even number of arcs joining to it).

Remember that the problem was to travel around town crossing each bridge only once. On Euler's network this meant tracing over each arc only once, visiting all the vertices. Euler proved it couldn't be done because he worked out that to have an odd vertex you would have to begin or end the trip at that vertex. (Think about it). Since there can only be one beginning and one end, there can only be two odd vertices if you're going to be able to trace over each arc only once. Since the bridge problem has 4 odd vertices, it just isn't possible to do! What happens if there are no odd vertices at all? Can this network be traced?



The invention of networks began a whole new type of geometry called **Topology**. Topology is now used in many ways, including Google Maps and in-car satellite navigation systems.

The 1745 Rebellion - Timeline

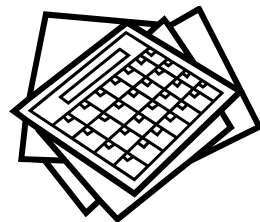
• I can create an accurate timeline and use it to answer questions (MNU 2-10a and 2-10b)

1. Accurately draw lines from the events to the correct place on the timeline.

<p>July</p> <p>August</p> <p>September</p> <p>October</p> <p>November</p> <p>December</p> <p>1746</p> <p>January</p> <p>February</p> <p>March</p> <p>April</p>	<ul style="list-style-type: none"> • Charles arrives on island of Eriskay (23 Jul 45) • Jacobites take Carlisle (14 Nov 45) • Jacobites leave Edinburgh for England (01 Nov 45) • Jacobites reach Linlithgow (15 Sep 45) • Jacobites reach Inverness and capture Fort George (20 Feb 46) • Jacobites enter Glasgow (26 Dec 45) • Jacobites army reaches Perth (04 Sep 45) • Charles raises his father's royal standard at Glenfinnan (19 Aug 45) • Jacobites enter Edinburgh (17 Sep 45) • Jacobites cross back into Scotland (20 Dec 45) • Cumberland arrives in Edinburgh (30 Jan 46) • Jacobites defeat Gen. Cope at the Battle of Prestonpans (21 Sep 45) • Jacobites enter Manchester (29 Nov 45) • Jacobites reach Derby (04 Dec 45) • Jacobites win the Battle of Falkirk (17 Jan 46) • Cumberland reaches Aberdeen (27 Feb 46) • Jacobites defeated at battle of Culloden (16 Apr 46)
--	--

2. How long were the Jacobites in England for? _____ days

3. In total, how many days did the '45 last? _____ days



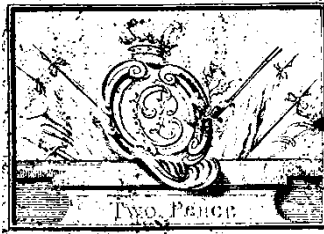
Jacobite Money

- I can investigate different combinations of banknotes (MNU 1-09b)
- I can compare costs between the 18th and 21st century (MNU 2-09a)

The capture of the Jacobite ship *Le Prince Charles*, with its cargo of money, left Charles facing the prospect of being unable to feed or supply his army. The Prince turned to Robert Strange to produce counterfeit money to finance his cause. Within two weeks Strange had designed banknotes illustrated with a rose and thistle, but before he could actually print any notes news reached him that the Duke of Cumberland had crossed the Spey. The next day Strange fought at Culloden and the money was never printed.



One Penny (1d)



Two Pence (2d)



Three Pence (3d)



Six Pence (6d)

1. Which notes would you use to pay (exactly) for the following items? Remember to use the least amount of notes possible.

- | | | | | | | | | |
|---------------------------|-------|-----------------------------|-------|-----------------------------|-------|-----------------------------|-------|-----------------------------|
| a. A bowl of oatmeal (2d) | _____ | <input type="checkbox"/> 1d | _____ | <input type="checkbox"/> 2d | _____ | <input type="checkbox"/> 3d | _____ | <input type="checkbox"/> 6d |
| b. A sporran (38d) | _____ | <input type="checkbox"/> 1d | _____ | <input type="checkbox"/> 2d | _____ | <input type="checkbox"/> 3d | _____ | <input type="checkbox"/> 6d |
| c. A dirk (47d) | _____ | <input type="checkbox"/> 1d | _____ | <input type="checkbox"/> 2d | _____ | <input type="checkbox"/> 3d | _____ | <input type="checkbox"/> 6d |
| d. A targe (65d) | _____ | <input type="checkbox"/> 1d | _____ | <input type="checkbox"/> 2d | _____ | <input type="checkbox"/> 3d | _____ | <input type="checkbox"/> 6d |
| e. Gunpowder (17d) | _____ | <input type="checkbox"/> 1d | _____ | <input type="checkbox"/> 2d | _____ | <input type="checkbox"/> 3d | _____ | <input type="checkbox"/> 6d |

2. If you could design 4 banknotes, what values would you make them? _____, _____, _____ & _____

Why did you choose these values? _____

3. The reward for Prince Charlie's capture was £30,000 in 1746. This is equivalent to £3,480,000 in today's money!

- What would £1 in 1746 be worth today? _____
- What would the most expensive item from Q1 be worth today? _____
- £500 of today's money would be worth how much in 1746? _____



The Prince's Household Book, 1746

• I can describe the money system used during the Jacobite uprisings and make calculations using the old system (MNU 2-03a, MNU 2-09a, MTH 2-12a)

In the 18th Century, the **pound** was divided into **twenty shillings** or **240 pennies**. It remained so until decimalization on 15 February 1971, when the pound was divided up as it is still done today.



£1 = 20 shillings
1 shilling = 12 pence



Mr James Gibb kept a detailed record of everything Prince Charlie bought during the '45 uprising. This extract is from 6th March 1746, the columns are pounds (£), shillings (-/) and pence (d):

	£	-/	d	
6 Thursday, at Inverness				
to a Salmond	0	5	0	6 + 4 = 10 pence, as this is less than 12 we write 10 in the pence column
to 3 barels for butter	0	3	6	
to Salt and Riss	0	2	4	The shillings column adds up to 23. As this is more than 20, we put 3 in the shillings column and carry £1 over to the pounds column.
to oingons and Roots	0	1	0	
to bread & oatt Do.	0	7	0	
to 1000 oysters	0	5	0	
	£1	3	10	

Here are the last items bought by the Prince in Inverness before the battle of Culloden in April 1746:

	£	-/	d
12 Saturday, at Inverness			
to 13 Load of pitts	0	8	3
to poltrie and Eggs	0	7	5½
to Greens Roott &c	0	2	3
to 1800 oysters	0	7	6
to Ladys kilracs Servant and Mrs Do- nin's Do	0	2	0
to a hair	0	0	9
to port of River watter	0	5	7
to 18 Load of pitts	0	12	0
to whit and oat bread	1	17	0
to Candles	1	0	0
13 Sunday, at Inverness			
14 Monday, at Inverness			
to 12 Load of pitts	0	8	0
to 3 pecks Salt	0	3	0
to Rootts and herbes	0	1	10
to a Glass and 2 padlocks	0	2	4

N:B: In the Evening the prince marched to Culloden-house.

Calculate the following:

1. How much money did the Prince spend on Monday 14th April 1746?

£ _____ -/ _____ d

2. How much money did the Prince spend on Saturday 12th April 1746?

£ _____ -/ _____ d

3. How much did the Prince spend altogether just before the battle?

£ _____ -/ _____ d

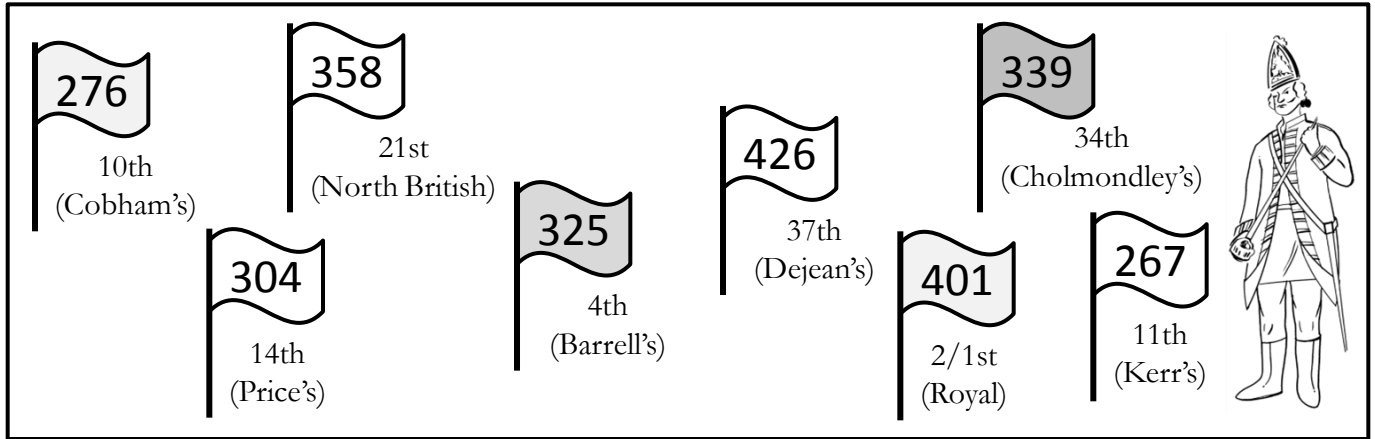
4. How many oysters would the Prince get for 1d on 12th April 1746? _____

5. Why do you think he bought a glass and 2 padlocks before leaving for Culloden?

British/Loyalist Forces at Culloden

• I can answer questions by adding 3-digit numbers and know how to check my answers (MNU 2-03a)

The flags below show the number of British/Loyalist forces in the front line units at Culloden:



- How many soldiers altogether are in the following units:
 - 10th (Cobham's) and 4th (Barrell's)
 - 14th (Price's) and 34th (Cholmondley's)
 - 11th (Kerr's) and 21st (North British)
 - 2/1st (Royal) and 37th (Dejean's)?
- The **Advance Guard** was made up from the 10th (Cobham's) Dragoons, the 11th (Kerr's) Dragoons and a Highland Battalion (around 300 soldiers).

How many soldiers were in the Advance Guard altogether?

- The **Front Line** was made up of the **First Brigade** and the **Third Brigade**.
 - The First Brigade was made up from the 2/1st (Royal) Regiment, the 34th (Cholmondley's) Foot and the 14th (Price's) Foot. How many soldiers were in the First Brigade?
 - The Third Brigade was made up from the 21st (North British) Fusiliers, the 37th (Dejean's) Foot and the 4th (Barrell's) Foot. How many soldiers were in the Third Brigade?
 - How many soldiers were in the Front Line?
- Calculate the totals.
 - Second Brigade, $413 + 350 + 412 = ?$
 - Fourth Brigade, $429 + 325 + 324 = ?$
 - Second Line, Second Brigade + Fourth Brigade = ?
 - Reserve, $211 + 410 + 354 + 300 = ?$
 - Total Troops, Front Line + Second Line + Reserve = ?

Casualties at Culloden

• I can use percentages in calculations to solve problems (MNU 2-07a)

This table contains the casualty figures for the Government troops at the Battle of Culloden, the numbers of Jacobite casualties are much larger and not known exactly.

Complete the table by calculating and filling in the totals and the percentages of soldiers killed and wounded:

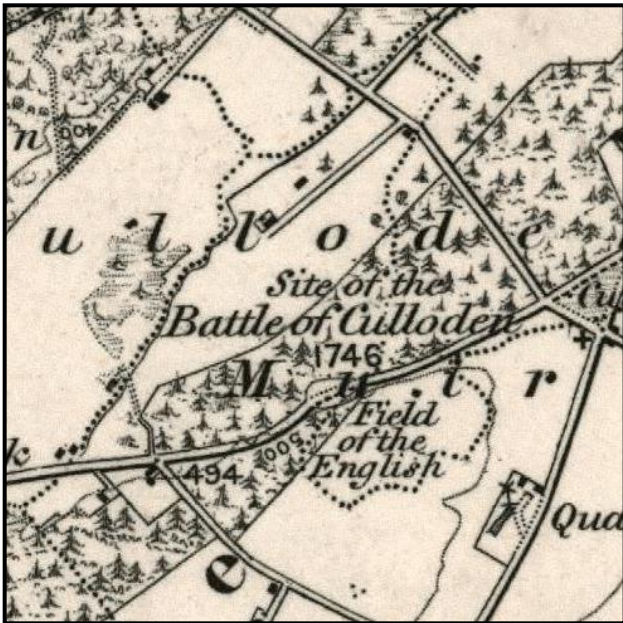
Hanoverian Army:	Killed	Wounded	Number in unit	% Killed	% Wounded
Cumberland's Hussars (escort)	0	0	20		
The Royals (1st)	0	4	401		
Howard's Old Buffs (3rd)	1	2	413		
Barrel's King's Own (4th)	17	108	325		
Wolfe's (8th)	0	1	324		
Pulteney's (13th)	0	0	510		
Price's (14th)	1	9	304		
Bligh's (20th)	4	17	412		
Campbell's RSF (21st)	0	7	358		
Sempill's (25th)	1	13	429		
Blakeney's (27th)	0	0	300		
Cholmondeley's (34th)	1	2	339		
Fleming's (36th)	0	6	350		
Munro's (37th), (Dejean's)	14	69	426		
Ligonier's (59th), (Conway's)	1	5	325		
Battereau's (62nd) Foot	0	3	354		
Highland Militia (64th), (Loudon's)	6	4	300		
10th (Cobham's) Dragoons	1	0	276		
11th (Kerr's) Dragoons	3	3	267		
Duke of Kingston's 10th Horse	0	1	211		
Totals:					

Maps of Culloden

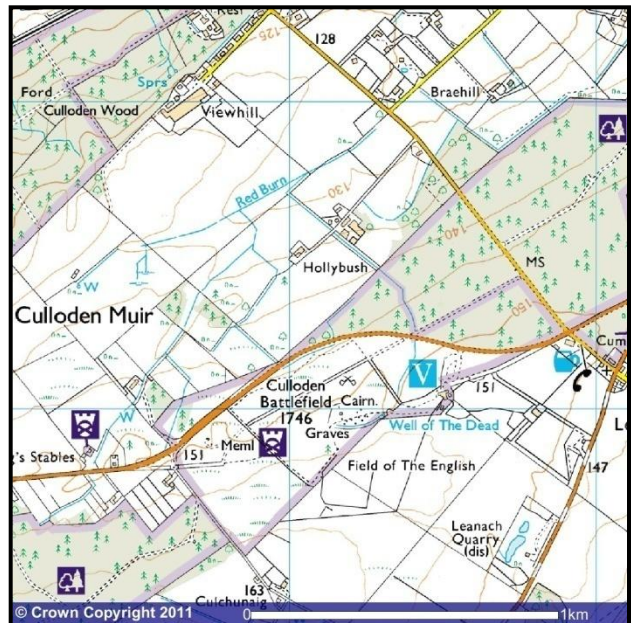
- I can investigate old maps and explore the use of scale (MTH 2-17d)

The two maps below show the site of the Battle of Culloden in 1911 and 2011.

1911



2011

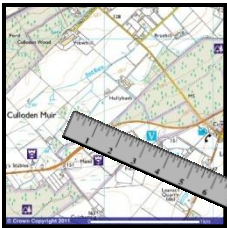


Discuss: What differences can you spot between the two maps?

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Image produced from Ordnance Survey's Get-a-map service. Image reproduced with permission of Ordnance Survey and Ordnance Survey of Northern Ireland.

The scale of these maps is 1 in 25,000, i.e. 1cm measured on the map represents 25,000cm in real life.



A distance of **2 cm** is measured on the map with a ruler...

$$2 \text{ cm} \xrightarrow[\text{x by the scale}]{\times 25,000} 50,000 \text{ cm} \xrightarrow{\div 100} 500 \text{ m}$$

So, **2 cm** measured on the map equals **500 m** in real life

1. What would these map measurements be in real life?

- | | |
|-------------------------------|------------------------------|
| a. 4 cm = _____ m = _____ km | d. 6 cm = _____ m = _____ km |
| b. 8 cm = _____ m = _____ km | e. 9 cm = _____ m = _____ km |
| c. 10 cm = _____ m = _____ km | f. 3 cm = _____ m = _____ km |

2. How long would these real life distances be drawn on the map?

- | | | |
|---------------------|------------------|-------------------|
| a. 1,250 m _____ cm | b. 3 km _____ cm | c. 500 m _____ cm |
|---------------------|------------------|-------------------|

Challenge: What is the total real life area represented by one of the maps above? _____ m²

After Culloden

• I can solve problems using a range of mathematical procedures (MNU 2-03b)

This extract from a memoir by Michael Hughes, one of Cumberland's soldiers, describes the sacking of a Jacobite laird's estate after Culloden:

'...the Duke sent out a party of Fourhundred Men to estate of Simon Frazer, Laird of Lovat, with orders to bring off all that was moveable and to burn down his dwelling house, out houses and all other appertenances, which was very cheerfully undertaken and performed. One thousand bottles of wine, three hundred Bows [bolls; 1 boll = 140lbs = 63kg] of oatmeal, with a large quantity of malt, and a Library of books to the value of Fourhundred pounds, was all brought to Innerness. His fine Salmon Weirs were destroyed, and Salmon in abundance was brought into the Camp and divided among the soldiers...'

1. How many bottles of wine were taken? _____
2. a. How many bowls of oatmeal were taken? _____
 - b. How many kg of oatmeal was in each bowl? _____ kg
 - c. How much oatmeal was taken altogether? _____ kg
3. a. How much were the library books worth that were taken? £ _____
 - b. What would this be worth in today's money? (use information from earlier sheet) £ _____

4. Use your Jacobite timeline to find out the significance of the answers to these multiplication questions:

(a) $\begin{array}{r} 349 \\ \times \quad 5 \\ \hline \end{array}$	(b) $\begin{array}{r} 245 \\ \times \quad 7 \\ \hline \end{array}$	(c) $\begin{array}{r} 298 \\ \times \quad 6 \\ \hline \end{array}$	(d) $\begin{array}{r} 563 \\ \times \quad 3 \\ \hline \end{array}$
--	--	--	--

(e) $\begin{array}{r} 191 \\ \times \quad 9 \\ \hline \end{array}$	(f) $\begin{array}{r} 873 \\ \times \quad 2 \\ \hline \end{array}$	(g) $\begin{array}{r} 569 \\ \times \quad 3 \\ \hline \end{array}$	(h) $\begin{array}{r} 427 \\ \times \quad 4 \\ \hline \end{array}$
--	--	--	--

(i) $\begin{array}{r} 289 \\ \times \quad 6 \\ \hline \end{array}$	(j) $\begin{array}{r} 345 \\ \times \quad 5 \\ \hline \end{array}$	(k) $\begin{array}{r} 857 \\ \times \quad 2 \\ \hline \end{array}$	(l) $\begin{array}{r} 243 \\ \times \quad 7 \\ \hline \end{array}$
--	--	--	--

Prince Charles's Wanderings – 1746

- I can solve problems using decimal numbers (MNU 2-02a, MNU 2-03b, MNU 2-07a)
- I can calculate how long a journey should take (MNU 2-10c)

1. Use the distance chart below to write down the distances from...



- Culloden to Fort Augustus _____ miles _____ km
- Fort Augustus to Achnacarry _____ miles _____ km
- Achnacarry to Borrodale House _____ miles _____ km
- Total distance _____ miles _____ km

**1 mile
=
1.6 km**

Naismith's Rule

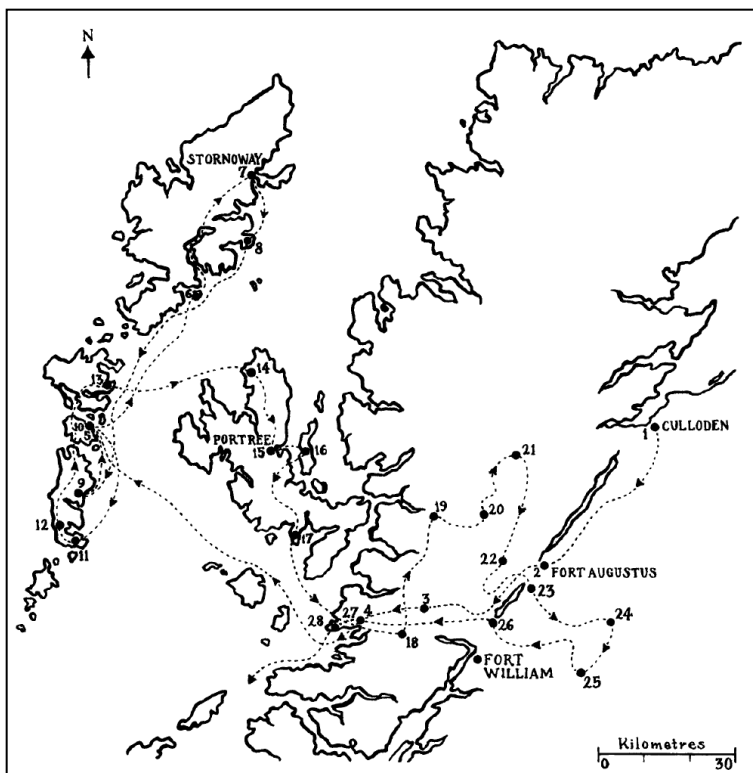
Naismith's Rule is a rule of thumb that helps in the planning of a walking or hiking expedition by calculating how long it will take to walk the route. The simplified basic rule is as follows:

Allow 1 hour for every 3 miles (5 km) forward.



2. Bonnie Prince Charlie took 9 days to walk from Culloden to Borrodale House near Arisaig. Use Naismith's Rule to calculate how long it would have taken him if he walked non-stop:

Answer: _____ days _____ hours _____ minutes



1. Culloden
2. Fort Augustus
3. Achnacarry
4. Borrodale House, near Arisaig

Distances in miles

	Culloden	Fort Augustus	Achnacarry	Borrodale
Culloden		36.2	55.9	97.7
Fort Augustus	36.2		20.6	60.1
Achnacarry	55.9	20.6		37.9
Borrodale	97.7	60.1	37.9	

Further Reading and Websites

Jacobite Money

- <http://digital.nls.uk/jacobite-prints-and-broadsides/pageturner.cfm?id=75241373> - See the notes that were never printed up close (the plates were found in a bog near Culloden).

The Prince's Household Book, 1746

- <http://digital.nls.uk/print/transcriptions/lyon/vol2/> - Read pages 115 onwards for the Accounts of James Gibb, Master of the Household to the Prince.
- <http://www.woodlands-junior.kent.sch.uk/customs/questions/moneyold.htm> - Understanding old money.

Maps of Culloden

- <http://maps.nls.uk/roy/index.html> - Roy Military Survey of Scotland, 1747-1755.
- <http://maps.nls.uk/os/index.html> - Ordnance Survey Maps, 1847-1930.
- <http://maps.nls.uk/detail.cfm?id=219> - Find Culloden on this map from 1732.
- <http://www.getamap.ordnancesurveyleisure.co.uk/> - Ordnance Survey Get-a-Map for modern maps.

Prince Charles's Wanderings 1746

- <http://www.yourphotocard.com/Ascanius/documents/ITINERARYANDMAP.pdf> - Full itinerary.
- <http://www.1745association.org.uk/Long%20March.htm> - Bonnie Prince Charlie's Long March.

Websites checked January 2012