



‘Numeracy, arithmetic, maths – what age and at what stage?’

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Numeracy

- ...might be seen as a quality of successful learners of mathematics (Coben, 2003), or as a proficiency which involves confidence and competence with numbers and measures, and the ability to solve number problems in a variety of contexts
- **The wages of a man for a day’s work are 5s 6d, and for a woman 2s 9d. A man can do one and a half times as much work as a woman can do in the same time. Certain work has to be done which would occupy 50 men for 80 days; find the difference in the cost if 20 men and 30 women were employed to do the work instead of 50 men** (source: *Guide to employment in the Civil Service, 1911: Entrance examination, Women and girl clerks*)

***Problem solving-fluency -robustness-problem solving-
arithmetic-proportional reasoning***

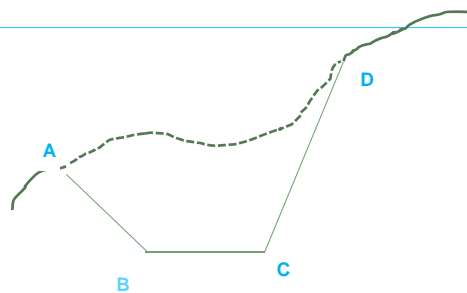
Arithmetic

‘the study of operations relating to quantity’

	£	s	d		£	s	d		£	s	d		£	s	d	
	46	11	10		335	2	3		356	18	4					
	43	5	2		375	15	8		2458	4	7					
	34	16	6		956	17	10		132	15	11					
	83	19	10		246	4	7		573	14	8					
	4	12	11		24	9	4		802	7	3					
	87	16	4		753	3	9		3025	13	9					
	16	2	8		754	16	2		2617	6	2					
	24	18	4		673	12	8		459	9	10					
	28	14	2		723	18	11		728	2	8					
	89	12	8		904	11	3		256	15	3					
	27	13	10		46	8	7		287	18	5					
	9	17	35		256	13	2		153	3	7					
	13	12	0		235	19	9		893	5	10					
	48	16	3		135	13	11		460	6	3					
	40	9	8		435	5	6		247	14	8					
	31	4	4		36	15	2		2793	18	4					
	50	12	5		15	17	9		261	1	5					
	53	17	3		257	8	10		5832	9	9					
	14	17	11		133	10	9		476	12	2					
Total																

Source: Entrance paper, second division clerks

Fluency - robustness with core number procedures: to be employed efficiently and accurately, using electronic tools when appropriate



The figure shows the section of a railway cutting on the scale of 1 to 400, the dotted line being the original outline of the ground. Find the area of the cross-section ABCD, and hence find the number of tons of earth that have to be moved to make such a cutting a quarter of a mile long, taking the weight of a cubic yard of earth to be 38 cwt.

Source: Entrance paper, second division clerks

Problem-solving – modelling - reasoning - fluency

Age? I suggest.....

- **Mathematics begins pre-school, in everyday and play experience and talk about pattern, shape, and a developing sense of number, that are harnessed to explore and describe the world and to begin to solve problems. All young people are curious and respond to challenge; and that extends to a curiosity about mathematics that should be nurtured and valued through multiple experiences of core mathematical concepts supported by knowledgeable and effective teachers.**



ACME Mathematical Needs Reports 2011

- ***All young people are entitled to education in the range of mathematics components, and building up of a range of mathematical proficiencies: that is a question of equity and of empowerment.***
- ***Employers and Higher Education need young people with more robust mathematical skills (not just number) and ability to apply those reliably; and in general, more young people who know more mathematics and can use it confidently and competently. This includes a competence and confidence to model and to solve problems.***



- These are not incompatible but need creative and knowledgeable teaching at all stages (cf NC response, Raising the Bar, extant and emergent proposals for the range of mathematical needs post-16)
- Focus for a 21st century curriculum should be on **problem solving within and beyond mathematics**, so including modelling; and supported by the development of deep conceptual understanding, robust and fluent skills and knowledge, and increasingly rigorous mathematical reasoning
- **Technology** affords exciting opportunities for supporting the exploration and learning of mathematics, as well as its use.
- Young people of all ages should often experience **challenge, collaboration, excitement** in mathematics, opportunities to **explore and to create, link-making** across the curriculum, and expectations of **communicating** their mathematics in a variety of ways and with increasing rigour.

- Important **affective characteristics** also need to be nurtured: perseverance, resilience, the embracing of risk and challenge, an inclination to engage with mathematics and the confidence to do so...
- This can only happen with a **whole-system consistency and coherence** that is research-informed: assessment and accountability measures that are fully aligned with valued outcomes, and especially that value depth of pure and applied mathematical thinking rather than superficial acquaintance with material; a professional and expert teaching workforce able to enact this vision at a local level
- It should be based on **cross-party consensus** not on short-term initiatives, however well-intentioned, that destabilise and undermine effective T&L. Our young people's education is too important for that – for them as individuals and for national needs