Core 2 Logarithms Questions
(From the Oxford MAT Tests)

For answers, see the MAT website

Specimen A, Question 1h:

H. Given that

$$\log_{10} 2 = 0.3010 \text{ to 4 d.p. and that } 10^{0.2} < 2$$

it is possible to deduce that

(a) 2^{100} begins in a 1 and is 30 digits long;
(b) 2^{100} begins in a 2 and is 30 digits long;
(c) 2^{100} begins in a 1 and is 31 digits long;
(d) 2^{100} begins in a 2 and is 31 digits long.

Specimen B, Question 1i:

I. .Observe that $2^3 = 8$, $2^5 = 32$, $3^2 = 9$ and $3^3 = 27$. From these facts, we can deduce that $\log_2 3$, the logarithm of 3 to base 2, is

(a) between $1\frac{1}{3}$ and $1\frac{1}{2}$;
(b) between $1\frac{1}{2}$ and $1\frac{2}{3}$;
(c) between $1\frac{2}{3}$ and 2;
(d) between 2 and 3.

2007, Question 1f:

F. The equation

$$8^x + 4 = 4^x + 2^{x+2}$$

has

(a) no real solutions;
(b) one real solution;
(c) two real solutions;
(d) three real solutions.

2007, Question 1i:

I. Given that a and b are positive and

$$4\,(\log_{10} a)^2 + (\log_{10} b)^2 = 1,$$

then the greatest possible value of a is

$$\text{(a)}\quad \frac{1}{10}, \qquad \text{(b)}\quad 1, \qquad \text{(c)}\quad \sqrt{10}, \qquad \text{(d)}\quad 10^{\sqrt{2}}.$$

2008, Question 1b:

B. Which is the smallest of these values?

$$\text{(a)}\quad \log_{10}\pi, \qquad \text{(b)}\quad \sqrt{\log_{10}(\pi^2)}, \qquad \text{(c)}\quad \left(\frac{1}{\log_{10}\pi}\right)^3, \qquad \text{(d)}\quad \frac{1}{\log_{10}\sqrt{\pi}}.$$

2010, Question 1e:

E. Which is the largest of the following four numbers?

$$\text{(a)}\quad \log_2 3, \qquad \text{(b)}\quad \log_4 8, \qquad \text{(c)}\quad \log_3 2, \qquad \text{(d)}\quad \log_5 10.$$

2011, Question 1h:

H. The number of *positive* values x which satisfy the equation

$$x = 8^{\log_2 x} - 9^{\log_3 x} - 4^{\log_2 x} + \log_{0.5} 0.25$$

is

(a) 0, (b) 1, (c) 2, (d) 3.

2012, Question 1c:

C. Which is the *smallest* of the following numbers?

(a) $\left(\sqrt{3}\right)^3$, (b) $\log_3\left(9^2\right)$, (c) $\left(3\sin\frac{\pi}{3}\right)^2$, (d) $\log_2\left(\log_2\left(8^5\right)\right)$.

2013, Question 1f:

F. Three *positive* numbers a, b, c satisfy

$$\log_b a = 2, \qquad \log_b(c-3) = 3, \qquad \log_a(c+5) = 2.$$

This information

(a) specifies a uniquely.
(b) is satisfied by two values of a.
(c) is satisfied by infinitely many values of a.
(d) is contradictory.

2013, Question 1j:

J. For a real number x we denote by $[x]$ the largest integer less than or equal to x.

Let n be a natural number. The integral

$$\int_0^n [2^x]\,\mathrm{d}x$$

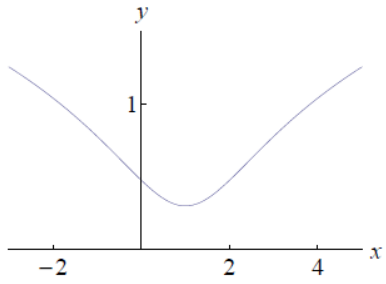
equals

(a) $\log_2((2^n-1)!)$; (b) $n2^n - \log_2((2^n)!)$; (c) $n2^n$; (d) $\log_2((2^n)!)$,

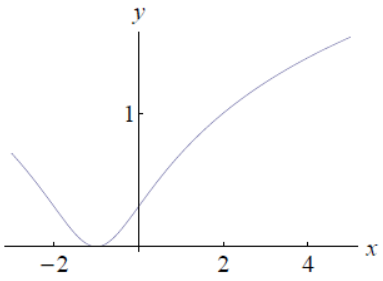
where $k! = 1 \times 2 \times 3 \times \cdots \times k$ for a positive integer k.

2014, Question 1b:

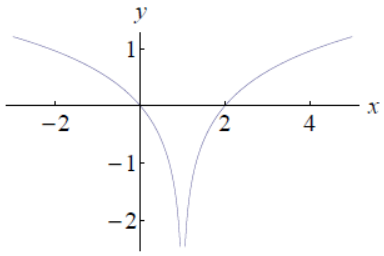
B. The graph of the function $y = \log_{10}(x^2 - 2x + 2)$ is sketched in



(a)



(b)



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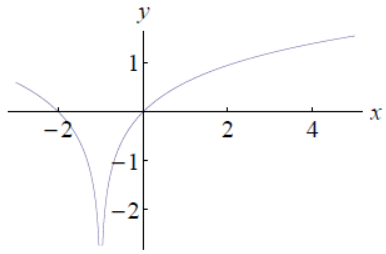
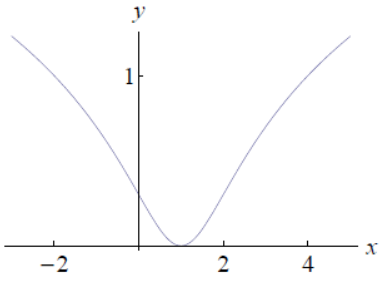


(d)



(e)