F Michaelmas Trial Practice 3

1. Write $\frac{7}{16}$ as a decimal. $\boxed{0.4375}$

2. Calculate

   (a) $\dfrac{0.0016}{0.000004}$. $\boxed{400}$

   (b) 23.4×0.004. $\boxed{0.0936}$

   (c) $\frac{2}{3} - \frac{1}{4} \div \frac{3}{5}$. $\boxed{\frac{1}{4}}$

   (d) $(1 - (2 - (3 - (4 - 5))))$. $\boxed{3}$

   (e) $\frac{32}{14} \div \frac{40}{77}$. $\boxed{\frac{22}{5}}$

3. By rounding every component of the calculation to 1 significant figure, estimate the value of $\dfrac{7.98 + \sqrt{449.9}}{0.0243}$. $\boxed{1400}$

4. Solve the simultaneous equations $\begin{matrix} x + y = a \\ bx + 2y = c \end{matrix}$, giving your answers as single fractions.

   $\boxed{(x, y) = \left(\frac{2a-c}{2-b}, \frac{c-ab}{2-b}\right)}$

5. Expand and simplify fully:

   (a) $(x - \frac{3}{y})^3$. $\boxed{x^3 - \frac{9x^2}{y} + \frac{27x}{y^2} - \frac{27}{y^3}}$

   (b) $(5x + 3)^2 - (x - 7)(4x - 1)$. $\boxed{21x^2 + 59x + 2}$

   (c) $\left(4x - \dfrac{3}{y}\right)\left(y - \dfrac{3}{x}\right)$. $\boxed{4xy - 15 + \frac{9}{xy}}$

6. Solve for x:

   (a) $\frac{3}{8} - \frac{3}{x-1} = \frac{1}{16}$. $\boxed{x = \frac{53}{5}}$

   (b) $\sqrt{\dfrac{ax - 7}{bx + c}} = k$. $\boxed{x = \frac{7+k^2c}{a-bk^2}}$

   (c) $1 - \dfrac{x - 2}{2} = \dfrac{x + 1}{3} - \dfrac{x - 2}{4}$. $\boxed{x = 2}$

   (d) $\dfrac{1}{9^{2x}} = \dfrac{27^{2x-3}}{3^{4x-1}}$. $\boxed{x = \frac{4}{3}}$

7. Solve the following inequalities:

   (a) $\frac{4x-3}{-6} + 7 > -3(x + 7)$. $\boxed{x > \frac{171}{14}}$

   (b) $-11 < 3x + 4 \leqslant 37$. $\boxed{-5 < x \leqslant 11}$

   (c) $\dfrac{x + 5}{7} < 2 - \dfrac{x - 1}{-5} \leqslant \dfrac{x}{10}$. $\boxed{-19 < x \leqslant -18}$

8. Simplify fully:

   (a) $\dfrac{(a^{-2})^2 \times a^{-15}}{(a^{-7})^3 \div a^{-3}}$. $\boxed{a^{-1}}$

   (b) $\dfrac{(4xy^2)^3 \times (x^5y^{-7})^3}{(2x^{-2}y^{-11})^3}$. $\boxed{8x^{24}y^{18}}$

(c) $\dfrac{ax-b}{2b-2ax}$. $-\frac{1}{2}$

9. A smelly, stinking cat eats $\frac{3}{8}$ of a can of cat food every day. How long does it take the cat to eat 39 cans? 104 days

10. There are an equal number of orange and green fish in a tank. Three of the green fish die and are removed. $\frac{4}{11}$ are now green. How many fish were there in the tank to begin with?

14 fish

11. Draw a Venn diagram with three sets A, B and C overlapping in the usual way. Shade the region $(A \cap B) \cup (B' \cap C')$.

12. If a cannibals can eat 7 people in k days, how long does it take 8 cannibals to eat k people?

$\frac{k^2 a}{56}$ days

13. $P = 7^9 \times 11^4 \times 13$
$Q = 5^3 \times 7^8 \times 13^3$.

(a) Write (as a product of primes) the HCF of P and Q. $\text{HCF} = 7^8 \times 13$

(b) Write (as a product of primes) the LCM of P and Q. $\text{LCM} = 5^3 \times 7^9 \times 11^4 \times 13^3$

14. A Venn diagram has three sets A, B, C and D. $A \cap B = \emptyset$. $C \cap D = \emptyset$. $C \subset A$. $D \subset A$. Draw the Venn diagram.

Non overlapping big circles A and B. C and D not overlapping entirely within A.

15. If Tori can paint the fence in 5 minutes and Tori and Simon (together) can paint the same fence in 2 minutes, how long will it take Simon working alone? $\frac{10}{3}$ minutes

16. $\xi = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{1, 3, 5, 6, 9\}$ and $B = \{2, 3, 4, 7, 8\}$.

(a) A'. $\{2, 4, 7, 8\}$

(b) $A \cup B$. $\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$

(c) $A \cup B'$. $\{1, 3, 5, 6, 9\}$

(d) $n(B')$. 4

(e) $n(A' \cap B')$. 0

(f) Is $8 \in B$? Yes

(g) Is $4 \in A'$? Yes