

School of Mathematical Sciences

MTH3100 ESSENTIAL MATHEMATICAL
SKILLS EXAMINATION

Wednesday 5th October 2011, 14:00–16:00 Duration: 2 hours.

Apart from this page, you are not permitted to read the contents of this question paper until instructed to do so by an invigilator.

To pass the exam, you need 12 correct answers.

Record each answer by filling in the corresponding box in the answer form.

Calculators are NOT permitted in this examination. The unauthorized use of a calculator constitutes an examination offence.

Candidates should note that the Examination and Assessment Regulations state that possession of unauthorized materials by any candidate who is under examination conditions is an assessment offence. Please check your pockets now for any notes that you may have forgotten that are in your possession. If you have any, then please raise your hand and give them to an invigilator now.

Exam papers must not be removed from the examination room.

Examiner(s): B. J. Carr

1. Determine the number of primes lying between 51 and 71, end-points included

- [a] 5 [b] 6
[c] 7 [d] 8 [e] not in the list

2. Determine the greatest common divisor x of 21^3 and 315

- [a] $1 \leq x < 10$ [b] $10 \leq x < 20$
[c] $20 \leq x < 40$ [d] $40 \leq x < 60$ [e] not in the list

3. Determine the integer nearest to $\frac{1504}{11}$

- [a] 134 [b] 135
[c] 136 [d] 137 [e] not in the list

4. Evaluate

$$-\frac{1}{9} \times \left\{ \frac{1}{2} - \left[-\frac{33}{32} \times \left(-\frac{7}{11} + 1 \right)^2 \div \frac{1}{11} \right]^2 \times \left(\frac{1}{3} + \frac{1}{9} \right) \right\} \div \left(\frac{1}{4} - \frac{1}{3} \right)$$

- [a] 3 [b] $\frac{1}{3}$
[c] $-\frac{1}{21}$ [d] $\frac{1}{27}$ [e] not in the list

5. Estimate

$$x = 10^4 \times \frac{14999}{300} \times \frac{1}{51}$$

- [a] $10^6 < x < 10^7$ [b] $10^5 < x < 10^6$
[c] $10^4 < x < 10^5$ [d] $10^3 < x < 10^4$ [e] not in the list

6. Simplify

$$\left(\frac{1}{(-1)^3}\right)^2 \left(\frac{-q^3}{(1/r)^2}\right)^3 \left(\frac{-q^4}{(pq)^2 r}\right)^{-1}$$

[a] $\frac{q^7 p^2}{r^5}$

[b] $-q^4 p^2 r^7$

[e] not in the list

[c] $q^7 p^2 r^7$

[d] $q^4 p^2 r^6$

7. Compute the remainder of the following division

$$(x^4 - x^3 + 1) \div (x^2 - 3)$$

[a] $10 - x$

[b] $-10x + 3$

[e] not in the list

[c] $3x + 10$

[d] $-3x + 10$

8. When $50a^2 - 2b^4 - b^6 + (5ab)^2$ is factored *completely*, one of these factors is

[a] $2 + b$

[b] $2 - b^2$

[e] not in the list

[c] $5a + b$

[d] $25a^2 - b^4$

9. Simplify

$$\frac{2x}{x+2} + \frac{x}{x+3} - \frac{x^2 + 4x - 4}{x^2 + 5x + 6}$$

[a] $\frac{x^4 + 9x^3 + 30x^2 + 44x + 22}{(x+3)(x+2)(x^2 + 5x + 6)}$

[b] $\frac{x^2 - 2x + 4}{(x+3)(x+2)}$

[e] not in the list

[c] $\frac{5x^2 + 4x + 4}{(x+3)(x+2)}$

[d] $\frac{2x^2 + 4x - 4}{(x+3)(x+2)}$

10. Simplify

$$(2x - 3)^2 - \left\{ (x - 3)^2 - 3 \left[\left(x + \frac{1}{2} \right)^2 - \left(\frac{1}{2} - x \right)^2 \right] \right\}$$

[a] $3x^2$

[b] $3x^2 - 12x$

[e] not in the list

[c] $9x^2 - 6x$

[d] $9x^2 - 6x + \frac{3}{2}$

11. Compute $f(-(2/X)^2)$, where

$$f(k) = \frac{1}{k} + \frac{2}{k^2} - \frac{8k - k^3}{k^3}$$

[a] $-\frac{3}{8}X^4 - \frac{1}{4}X^2 + 1$

[b] $-\frac{3}{2}X^4 - \frac{1}{2}X^2 + 1$

[e] not in the list

[c] $-\frac{3}{8}X^4 - \frac{1}{4}X^2 - 1$

[d] $\frac{5}{8}X^4 + \frac{1}{4}X^2 + 1$

12. Simplify, eliminating radicals at denominator

$$\frac{1}{\sqrt{3}} \frac{\sqrt{12} - \sqrt{21}}{\sqrt{7} - 3}$$

[a] $\frac{1 + \sqrt{7}}{4}$

[b] $\frac{-1 - \sqrt{7}}{2}$

[e] not in the list

[c] $\frac{1 + \sqrt{7}}{2}$

[d] $\frac{1 + 5\sqrt{7}}{2}$

13. Simplify, eliminating radicals at denominator (assuming all radicands positive)

$$\frac{\sqrt{b^3 - 4b}}{\sqrt{b}} - \frac{\sqrt{4b + 8}}{2}$$

[a] $\sqrt{b + 2} - \sqrt{b^2 - 4}$

[b] $\frac{\sqrt{b}\sqrt{b(b^2 - 4)} - \sqrt{2b + 2}}{b}$

[e] not in the list

[c] $\frac{\sqrt{b}\sqrt{b^3 - 8b - 8}}{4b}$

[d] $\sqrt{b + 2} (\sqrt{b - 2} - 1)$

14. Solve

$$\frac{1}{2}x - \frac{6x - 3}{6} > \frac{x - 1}{3} + 2x + 5$$

[a] $x < -\frac{31}{17}$

[b] $x < -\frac{25}{17}$

[c] $x > -\frac{25}{17}$

[d] $x < -\frac{29}{17}$

[e] not in the list

15. Solve $x + \sqrt{2x + 1} = 2$

[a] $3 + \sqrt{6}$

[b] $\frac{-6 \pm \sqrt{24}}{2}$

[c] $3 - \sqrt{6}$

[d] no solution

[e] not in the list