

Duration: 2 hours. To pass the exam, you need 12 correct answers.

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

Calculators are NOT permitted in this examination.

- 1.** Determine the number of primes lying between 89 and 109, end-points included

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

- 2.** Determine the greatest common divisor x of 100^3 and 880

[a] $10 \leq x < 25$	[b] $25 \leq x < 50$	
		[e] not in the list
[c] $50 \leq x < 75$	[d] $75 \leq x < 150$	

- 3.** Determine the fractional part of $\frac{2019}{11}$

[a] $\frac{9}{11}$	[b] $\frac{6}{11}$	
		[e] not in the list
[c] $\frac{8}{11}$	[d] $\frac{2}{11}$	

4. Evaluate

$$\left[-\frac{16}{3} \times \left(2 + \frac{3}{5} \right) \times \left(-\frac{1}{2} \right)^3 - \left(\frac{1}{2} - \frac{1}{3} \right) \right] \times \frac{21}{3} \times \left(-\frac{2}{47} \right) \div \left(\frac{2}{3} - 2 \right)$$

[a] $\frac{7}{5}$

[b] $\frac{4}{47}$

[e] not in the list

[c] $\frac{11}{47}$

[d] $\frac{7}{20}$

5. Estimate

$$x = \frac{10^{-3} \times 999}{8001^2} \times 2^6$$

[a] $10^{-3} < x < 10^{-2}$

[b] $10^{-4} < x < 10^{-3}$

[e] not in the list

[c] $10^{-5} < x < 10^{-4}$

[d] $10^{-6} < x < 10^{-5}$

6. Simplify

$$\frac{(-1)^2}{(-x)^{10}} \left(\frac{(-1/y)^3}{-x^{-3}} \right)^3$$

[a] $\frac{1}{xy^9}$

[b] $-\frac{1}{xy^9}$

[e] not in the list

[c] $\frac{1}{x^{19}y^9}$

[d] $-\frac{1}{x^4y^6}$

7. Compute the quotient of the following division

$$(4y^5 - y^4 + y^2 + 1) \div (y^3 + y^2 - 3)$$

[a] $4y^2 - 5y + 5$

[b] $4y^2 - 3y + 3$

[e] not in the list

[c] $4y^2 - 3y + 5$

[d] $4y^2 - 5y - 3$

8. When $35a^5b + 21a^3b^2 - 10a^6 - 6a^4b$ is factored completely, one of these factors is

- [a] $7b + 2a$ [b] $5a^2 + 3b$ [e] not in the list
[c] $-2a^2 + 7b$ [d] $7a^2 + 2b$

9. Simplify

$$\frac{2 - 14x}{1 - 14x + 49x^2} - \frac{4 - x^2}{7x - 1}$$

- [a] $-\frac{x^2 + 6}{7x - 1}$ [b] $\frac{x^2 - 2}{1 - 7x}$ [e] not in the list
[c] $\frac{x^2 - 6}{7x - 1}$ [d] $-\frac{x^2 + 2}{1 - 7x}$

10. Simplify

$$\left(\frac{a}{3} - \frac{b}{9}\right) \left[\frac{1}{4} \left(3a - \frac{2}{3}b\right)^2 + \left(\frac{3}{2}a + \frac{1}{3}b\right)^2 + \left(3a - \frac{2}{3}b\right) \left(\frac{3}{2}a + \frac{1}{3}b\right) \right]$$

- [a] $(3a + b)a^2$ [b] $3a^3 - \frac{1}{3}a^2b - \frac{2}{9}ab^2$ [e] not in the list
[c] $3a^3 - a^2b$ [d] $(3a - b) \left(a^2 + \frac{4}{9}b^2\right)$

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

$$f(\beta) = \frac{1}{-\beta + \frac{1}{\beta^3 - 3}}$$

- [a] $-\frac{y^2(x^3 + 3y^6)}{x^4 + 3xy^6 + y^8}$ [b] $\frac{y^2(x^3 - 3y^6)}{x^4 - 3xy^6 - y^8}$ [e] not in the list
[c] $\frac{y^2(x^3 + 3y^6)}{-x^4 + 3xy^6 - y^8}$ [d] $\frac{y^2(x^3 + 3y^6)}{x^4 + 3xy^6 - y^8}$

12. Simplify, eliminating radicals at denominator

$$\left(\sqrt{20} - \sqrt{\frac{49}{5}}\right) \frac{4}{3 + \sqrt{5}}$$

[a] $-3 + \frac{9}{5}\sqrt{5}$

[b] $\frac{15 + 9\sqrt{5}}{5}$

[e] not in the list

[c] $17 + \frac{51}{5}\sqrt{5}$

[d] $\frac{-75 + 9\sqrt{5}}{5}$

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

$$\sqrt{a^{-1} - 4a^3} \sqrt{(1 + 2a^2)^{-1}}$$

[a] $\frac{\sqrt{a}\sqrt{1 + 2a^2}}{a}$

[b] $\frac{\sqrt{a(1 - 2a^2)}}{a}$

[e] not in the list

[c] $\frac{\sqrt{a(1 - 4a^4)}}{1 + 2a^2}$

[d] $\frac{\sqrt{a(1 - 4a^2)}}{a}$

14. Solve

$$\left(k + \frac{1}{2}\right)^2 - (k - 1)^2 - 6k < 5k - 3$$

[a] $k > \frac{9}{32}$

[b] $k > \frac{3}{16}$

[e] not in the list

[c] $k < -\frac{15}{32}$

[d] $k > \frac{17}{40}$

15. Find all solutions of

$$\frac{1 - x}{3\sqrt{x - 2}} = 1$$

[a] $\frac{11 + 3\sqrt{5}}{2}$

[b] $\frac{11 - 3\sqrt{5}}{2}$

[e] not in the list

[c] no solution

[d] $\frac{7 \pm 3\sqrt{3}}{2}$

End of examination paper