

TEST 7**Basic Algebra****Marks: /60****Time: 1 hour 30 minutes**

Name:

Date:

INSTRUCTIONS TO CANDIDATES**Section A (30 marks)****Time: 45 minutes**

1. Answer **all** the questions in this section.
2. Calculators may **not** be used in this section.
3. All working must be clearly shown. Omission of essential working will result in loss of marks.
4. The marks for each question is shown in brackets [] at the end of each question.

- 1 Given that $a = -2$, $b = -3$ and $c = 2\frac{14}{25}$, evaluate $b^2 - 2a^3 + \sqrt{c}$.

Answer [2]

2 Simplify

(a) $12x - 15y - 3(6x - 9y)$,

(b) $6xy + 2y \times 3x$,

(c) $\frac{1}{3}\left[7x + \frac{1}{5}(10x - 15)\right]$.

Answer (a) [1]

(b) [1]

(c) [1]

5 Simplify each of the following.

(a) $\frac{5}{2x} - \frac{4}{3x}$

(b) $\frac{7x-5}{6} - \frac{3(x-2)}{4}$

Answer (a) [1]

(b) [3]

6 Linda bought x pencils at y cents per dozen. She sold them for z cents each. Find an expression for the profit in cents that she made.

Answer cents [3]

7 (a) Simplify $18a^2b^3 \div 12ab^2 \div \frac{3}{a^2b}$.

(b) Use your answer from (a) to evaluate $18a^2b^3 \div 12ab^2 \div \frac{3}{a^2b}$ when $a = -\frac{1}{2}$ and $b = -4$.

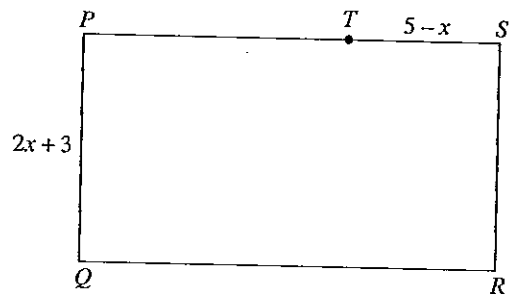
Answer (a) [2]

(b) [1]

8 $PQRS$ is a rectangle and T is a point on PS . Given that $PQ = (2x + 3)$ cm, $ST = (5 - x)$ cm and the perimeter of the rectangle is $(14x - 10)$ cm. Find, in terms of x , an expression for

- (a) QR ,
- (b) PT

giving each answer in its simplest form.



Answer (a) $QR =$ cm [2]

(b) $PT =$ cm [1]

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- 9 The average mass of m apples and n pears is p grams. If the average mass of the apples is q grams, find an expression for the average mass of the pears.

Answer (a) grams [3]

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- 10 A shopkeeper bought 24 pens at x cents each and 40 pencils at y cents each. He then repacked the pens and pencils into packets which contained 3 pens and 5 pencils. He sold each packet for $(7x + 8y)$ cents each.
- (a) Write down, in terms of x and y , an expression for
- (i) the amount of money he spent on the stationery,
 - (ii) the total amount of money received for selling all the packets of stationery.
- (b) Find his profit, giving your answer as simply as possible.

Answer (a) (i) cents [1]

(ii) cents [1]

(b) cents [2]

INSTRUCTIONS TO CANDIDATES

Section B (30 marks)

Time: 45 minutes

1. Answer all the questions in this section.
2. Calculators may be used in this section.
3. All working must be clearly shown. Omission of essential working will result in loss of marks.
4. The marks for each question is shown in brackets [] at the end of each question.

11 Simplify

- (a) $6a^2 + 5a - 3a(a - 2) - 7(a - 3)$,
- (b) $15b - \{9b - [8c - 2(b - 3c)]\}$,
- (c) $3d - 2\{d - 4(d - 2e) - [(d - 3e) - (2d - e)]\}$.

Answer (a) [2]
 (b) [2]
 (c) [3]

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[1]

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12 Simplify

(a) $2x + \frac{3x - 2y}{3} - \frac{2x - 5y}{5}$,

(b) $\sqrt{p^3q} \div \sqrt{16q^2} \times \frac{q^2}{p}$.

Answer (a) [3]

(b) [3]

13 (a) Given that $p = \frac{1}{2}$, $q = -\frac{1}{3}$, $r = 6$ and $s = -4$, find the value of

$$\frac{9}{r - ps} + \frac{1}{\frac{1}{p} - \frac{1}{q}}$$

(b) Add $(3x^2 - 5x + 10)$ to $(9x^2 - 4x - 3)$ and then subtract the result from $(15x^2 - 13x - 8)$. Give your answer in descending powers of x .

Answer (a) [3]

(b) [3]

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- 14 (a) Five men bought some electric cables at a shop. Andy bought p pieces of cables each of length 50 m, Ben bought q pieces of cables each of length 65 m, Carl bought q pieces of cables each of length 80 m, Denise and Edward each bought p pieces of cables each of length 125 m. Write down an expression in terms of p and q for
- (i) the total number of cables bought by the men,
 - (ii) the total length of all the cables.
- (b) Jenna is n years old. Terence, her brother is 8 years older than Jenna. Their father is 3 times as old as Jenna. Find the father's age when Terence was born.

Answer (a) (i) cables [1]

(ii) metres [2]

(b) years [2]

- 15 (a) A businessman bought n pieces of paintings at $\$3y$ each at an auction and sold them at $\$(n - y)$ each. If he suffered a loss in the transaction, express his loss in terms of n and y .
- (b) A tailor sewed n cushion covers using different types of materials. p of them were made from cotton, $2p$ of them were made from silk and the rest of them were made from linen.
- (i) Express in terms of n and p , the number of cushion covers which were made from linen.
- (ii) If she sold each cotton cushion cover for $\$9$, each silk cushion cover for $\$24$ and each linen cushion cover for $\$18$, calculate the total amount she would receive for selling all the cushion covers, giving your answer in terms of n and p .

Answer (a) \$ [2]

(b) (i) [1]

(ii) \$ [3]

13. (a)

Shenton Private School		No. of students (Nearest hundred)
Level	No. of students	
Secondary 1	1095	1100
Secondary 2	1253	1300
Secondary 3	1570	1600
Secondary 4	2946	2900

(b) Estimated enrolment
 $= 1100 + 1300 + 1600 + 2900$
 $= 6900$
 ≈ 7000 (correct to the nearest thousand)

(c) (i) Estimated cost of tickets
 $= \frac{7000}{21} \times \30^{15}
 $= \$105\ 000$

(ii) Total no. of students who attended the concert
 $= \frac{3}{4} \times (1095 + 1253 + 1570 + 2946)$
 $= 5148$

Total no. of students and guests
 $= 4 \times 5148$
 $= 20\ 592$

Actual cost of tickets
 $= 20\ 592 \times \$30$
 $= \$617\ 760$
 $\approx \$617\ 800$ (correct to 4 sig. fig.)

14. (a) (i) $89.58\dot{7} = 89.5877\dots$
 $106.49\dot{2} = 106.49292\dots$
 $-2.7\dot{1}3 = -2.713713\dots$
 $16.8\dot{1} = 16.8181\dots$
 $55.\dot{5} = 55.5555\dots$
 Sum of 5 no.s
 $= 89.5877\dots + 106.4929\dots + (-2.7137\dots)$
 $+ 16.8181\dots + 55.5555\dots$
 ≈ 265.741 (correct to 3 d.p.)

(ii) Difference
 $= 106.4929\dots - (-2.7137\dots)$
 $= 109.2$ (correct to 4 sig. fig.)

(b) (i) Estimated amount
 $\approx 6 \times \$2 + 9 \times \$3.50 + 5 \times \$6$
 $= \$73.50$
 $\approx \$74$ (correct to the nearest dollar)

(ii) Actual amount
 $= 6 \times \$1.99 + 9 \times \$3.48 + 5 \times \$6.04$
 $= \$73.46$
 Difference
 $= \$74 - \73.46
 $= \$0.54$

15. (a) Estimated area of rectangular floor
 $\approx 5.0 \times 8.0$
 $= 40\ \text{m}^2$

Estimated amount
 $\approx 40 \times \$12$
 $= \$480$
 $\approx \$500$ (correct to the nearest hundred dollars)

(b) Volume of cuboid = Length \times Breadth \times Height

$$\text{Height} = \frac{\text{Volume}}{\text{Length} \times \text{Breadth}}$$

$$\text{Height} = \frac{56\ 489}{24.68 \times 19.76}$$

Estimated height $\approx \frac{56\ 000}{25 \times 20}$
 $= 112$
 $\approx 100\ \text{cm}$ (correct to 1 sig. fig.)

Test 7: Basic Algebra

Section A

1. $a = -2, b = -3, c = 2\frac{14}{25}$

$$b^2 - 2a^3 + \sqrt{c}$$

$$= (-3)^2 - 2(-2)^3 + \sqrt{2\frac{14}{25}}$$

$$= 9 - 2(-8) + \sqrt{\frac{64}{25}}$$

$$= 9 + 16 + \frac{8}{5}$$

$$= 25 + 1\frac{3}{5}$$

$$= 26\frac{3}{5}$$

Teacher's Tip

To evaluate an expression, just substitute the values of the variables with the given values.

2. (a) $12x - 15y - 3(6x - 9y)$

$$= 12x - 15y - 18x + 27y$$

$$= 12x - 18x - 15y + 27y$$

$$= -6x + 12y$$

Multiply each term inside the brackets by -3.

$$\begin{aligned} \text{(b) } 6xy \div 2y \times 3x \\ = \cancel{6}^3 \cancel{y}^1 \times \frac{1}{\cancel{2}^1} \times 3x \\ = 9x^2 \end{aligned}$$

$$\begin{aligned} \text{(c) } \frac{1}{3} \left[7x + \frac{1}{5}(10x - 15) \right] \\ = \frac{1}{3} [7x + 2x - 3] \\ = \frac{1}{3} [9x - 3] \\ = 3x - 1 \end{aligned}$$

$$3. \text{ (a) } 3(p - q) = 3p - 3q \quad \boxed{\text{T}}$$

$$\begin{aligned} \text{(b) } 4 \times (-2p)^3 &= 4 \times (-8p^3) \\ &= -32p^3 \\ &\neq -8p^3 \\ \therefore 4 \times (-2p)^3 &= -8p^3 \quad \boxed{\text{F}} \end{aligned}$$

$(-2p)^3 = (-2p) \times (-2p) \times (-2p) = -8p^3$

$$\begin{aligned} \text{(c) } (-3p)^2 &= 9p^2 \\ (-5p) \times 6p &= -30p^2 \\ \therefore 9p^2 &> -30p^2 \\ \therefore (-3p)^2 &< (-5p) \times (6p) \quad \boxed{\text{F}} \end{aligned}$$

$$\begin{aligned} 4. \text{ (a) Total no. of novels} \\ = 5 + n + 6 \\ = 11 + n \end{aligned}$$

$$\begin{aligned} \text{(b) Total cost of novels} \\ = \$[5x + 8n + 6(2x)] \\ = \$[5x + 8n + 12x] \\ = \$[8n + 17x] \end{aligned}$$

$$\begin{aligned} 5. \text{ (a) } \frac{5}{2x} - \frac{4}{3x} \\ = \frac{15 - 8}{6x} \\ = \frac{7}{6x} \end{aligned}$$

The LCM of 2x and 3x is 6x.

$$\begin{aligned} \text{(b) } \frac{7x - 5}{6} - \frac{3(x - 2)}{4} \\ = \frac{2(7x - 5) - 9(x - 2)}{12} \\ = \frac{14x - 10 - 9x + 18}{12} \\ = \frac{5x + 8}{12} \end{aligned}$$

The LCM of 6 and 4 is 12.

$$6. \text{ Cost of 12 pencils} = y \text{ cents} \quad \boxed{\text{1 dozen} = 12}$$

$$\text{Cost of 1 pencil} = \frac{y}{12} \text{ cents}$$

$$\begin{aligned} \text{Cost of } x \text{ pencils} &= x \times \left(\frac{y}{12} \right) \\ &= \frac{xy}{12} \text{ cents} \end{aligned}$$

$$\text{Sale of } x \text{ pencils} = xz \text{ cents}$$

$$\text{Profit made} = \left(xz - \frac{xy}{12} \right) \text{ cents}$$

$$\begin{aligned} 7. \text{ (a) } 18a^2b^3 \div 12ab^2 \div \frac{3}{a^2b} \\ = 18a^2b^3 \times \frac{1}{12ab^2} \times \frac{a^2b}{3} \\ = \frac{a^3b^2}{2} \end{aligned}$$



Teacher's Tip

Change \div to \times and invert the divisor.

$$\begin{aligned} \text{(b) } 18a^2b^3 \div 12ab^2 \div \frac{3}{a^2b} \\ = \frac{a^3b^2}{2} \quad \leftarrow \text{From part (a)} \\ = \frac{\left(-\frac{1}{2}\right)^3 (-4)^2}{2} \\ = \frac{-\frac{1}{8} \times 16}{2} \\ = \frac{-2}{2} \\ = -1 \end{aligned}$$

$$\begin{aligned} 8. \text{ (a) } QR &= [(14x - 10) - (2x + 3) - (2x + 3)] \div 2 \\ &= [14x - 10 - 2x - 3 - 2x - 3] \div 2 \\ &= [10x - 16] \div 2 \\ &= (5x - 8) \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{(b) } PT &= PS - TS \quad \boxed{PS = QR, \text{ since } PQRS \text{ is a rectangle.}} \\ &= (5x - 8) - (5 - x) \\ &= 5x - 8 - 5 + x \\ &= (6x - 13) \text{ cm} \end{aligned}$$

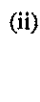
$$9. \text{ Total mass of apples and pears} = [(m + n)p] \text{ grams}$$

$$\begin{aligned} \text{Total mass of apples} \\ = mq \text{ grams} \end{aligned}$$

$$\begin{aligned} \text{Total mass of pears} \\ = [(m + n)p - mq] \text{ grams} \end{aligned}$$

$$\begin{aligned} \text{Average mass of pears} \\ = \left[\frac{(m + n)p - mq}{n} \right] \text{ grams} \\ = \left[\frac{mp + np - mq}{n} \right] \text{ grams} \end{aligned}$$

$$10. \text{ (a) (i) Amount spent} = (24x + 40y) \text{ cents}$$



Teacher's Tip

Each packet contained 3 pens and 5 pencils. \therefore 24 pens and 40 pencils can make 8 packets, i.e. $(8 \times 3 \text{ pens}, 8 \times 5 \text{ pencils})$.

$$\begin{aligned} \text{Total amount received} \\ = 8(7x + 8y) \\ = (56x + 64y) \text{ cents} \end{aligned}$$

$$\begin{aligned}
 \text{(b) Profit} &= \text{Amount received} - \text{Amount spent} \\
 &= (56x + 64y) - (24x + 40y) \\
 &= 56x + 64y - 24x - 40y \\
 &= (32x + 24y) \text{ cents}
 \end{aligned}$$

11.

Teacher's Tip

To simplify an algebraic expression containing brackets:

- Simplify the expressions within the brackets first, starting with the innermost brackets.
- If the expression inside the brackets is multiplied by a number or a variable, multiply each term inside the brackets by the number or the variable.

$$\begin{aligned}
 \text{(a)} \quad &6a^2 + 5a - 3a(a - 2) - 7(a - 3) \\
 &= 6a^2 + 5a - 3a^2 + 6a - 7a + 21 \\
 &= 3a^2 + 4a + 21
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad &15b - \{9b - [8c - 2(b - 3c)]\} \\
 &= 15b - \{9b - [8c - 2b + 6c]\} \\
 &= 15b - \{9b - [14c - 2b]\} \\
 &= 15b - \{9b - 14c + 2b\} \\
 &= 15b - \{11b - 14c\} \\
 &= 15b - 11b + 14c \\
 &= 4b + 14c
 \end{aligned}$$

$$\begin{aligned}
 \text{(c)} \quad &3d - 2\{d - 4(d - 2e) - [(d - 3e) - (2d - e)]\} \\
 &= 3d - 2\{d - 4d + 8e - [d - 3e - 2d + e]\} \\
 &= 3d - 2\{-3d + 8e - [-d - 2e]\} \\
 &= 3d - 2\{-3d + 8e + d + 2e\} \\
 &= 3d - 2\{-2d + 10e\} \\
 &= 3d + 4d - 20e \\
 &= 7d - 20e
 \end{aligned}$$

$$\begin{aligned}
 \text{12. (a)} \quad &2x + \frac{3x - 2y}{3} - \frac{2x - 5y}{5} \\
 &= \frac{30x + 5(3x - 2y) - 3(2x - 5y)}{15} \\
 &= \frac{30x + 15x - 10y - 6x + 15y}{15} \\
 &= \frac{39x + 5y}{15}
 \end{aligned}$$

The LCM of 3 and 5 is 15.

$$\begin{aligned}
 \text{(b)} \quad &\sqrt{p^3q} \div \sqrt{16q^2} \times \frac{q^2}{p} \\
 &= \sqrt{p^3q \div 4q \times \frac{q^2}{p}} \\
 &= \sqrt{p^3q \times \frac{1}{4q} \times \frac{q^2}{p}} \\
 &= \sqrt{\frac{p^2q^2}{4}} \\
 &= \sqrt{\left(\frac{pq}{2}\right)^2} \\
 &= \frac{pq}{2}
 \end{aligned}$$

$$\begin{aligned}
 \sqrt{16q^2} &= \sqrt{(4q)^2} \\
 &= 4q
 \end{aligned}$$

$$13. \text{ (a) } p = \frac{1}{2}, q = -\frac{1}{3}, r = 6, s = -4$$

$$\frac{9}{r - ps} + \frac{1}{p - \frac{1}{q}}$$

$$= \frac{9}{6 - \left(\frac{1}{2}\right)(-4)} + \frac{1}{\left(\frac{1}{2}\right) - \left(\frac{1}{-\frac{1}{3}}\right)}$$

$$= \frac{9}{6 + 2} + \frac{1}{\frac{1}{2} + 3}$$

$$= \frac{9}{8} + \frac{1}{5}$$

$$= 1\frac{13}{40}$$

$$\begin{aligned}
 \frac{1}{\frac{1}{2} - \left(\frac{1}{-\frac{1}{3}}\right)} &= \frac{1}{\frac{1}{2} + 3} \\
 &= \frac{1}{\frac{1}{2} + \frac{6}{2}} \\
 &= \frac{1}{\frac{7}{2}} \\
 &= \frac{2}{7}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad &(3x^2 - 5x + 10) + (9x^2 - 4x - 3) \\
 &= 12x^2 - 9x + 7 \\
 &15x^2 - 13x - 8 - (12x^2 - 9x + 7) \\
 &= 15x^2 - 13x - 8 - 12x^2 + 9x - 7 \\
 &= 3x^2 - 4x - 15
 \end{aligned}$$

14. (a) (i) Total no. of cables

$$= p + q + q + 2p = 3p + 2q$$

(ii) Total length of cables

$$\begin{aligned}
 &= 50p + 65q + 80q + 2(125p) \\
 &= 50p + 65q + 80q + 250p \\
 &= (300p + 145q) \text{ metres}
 \end{aligned}$$

(b) Terence's age = $(n + 8)$ yearsFather's age = $3n$ years

Father's age when Terence was born

$$= 3n - (n + 8)$$

$$= 3n - n - 8$$

$$= (2n - 8) \text{ years}$$

15. (a) Cost price of paintings

$$= \$(3y)(n)$$

$$= \$(3ny)$$

Selling price of paintings

$$= \$(n - y)(n)$$

$$= \$(n^2 - ny)$$

Loss = Cost price - Selling price

$$= \$3ny - \$(n^2 - ny)$$

$$= \$(3ny - n^2 + ny)$$

$$= \$(4ny - n^2)$$

(b) (i) No. of cushion covers made of linen

$$= n - p - 2p$$

$$= n - 3p$$

(ii) Total amount

$$= \$(9p + 2p(24) + (n - 3p)(18))$$

$$= \$(9p + 48p + 18n - 54p)$$

$$= \$(3p + 18n)$$