

BRIGIDINE COLLEGE RANDWICK



Year 11 Mathematics
March 21, 2007
Time 45 minutes

Student _____
Teacher _____

Show all necessary working.

Neatness may be taken into consideration in the awarding of marks.

If you make a mistake, transfer the question on to the last page (blank) of this exam.

1. Evaluate $\frac{\pi + \sqrt{6.85}}{60\%}$ to 2 decimal places. (2)

2. The distance from Sun to the Earth is 149 494 000 km . Write this in scientific notation correct to 3 significant figures. (2)

3. A car is sold for \$24300, which is a profit of 8% on its cost price. Find its cost price to the nearest dollar. (2)

4. If $x = \sqrt{a}$, find the value of $6a$ in terms of x . (1)

5. How many times must the number k be added to the number p to give a total of $4p + 3k$? (2)

6. Fully factorise these

i. $4m^2 - 19m + 12$ (2)

ii. $4x + 12y - xz - 3yz$ (2)

iii. $48 - 27m^2$ (2)

7. Simplify fully

i. $(3x - 4)(4x + 2x^2 - 5)$ (2)

ii. $(a + b)^2 - (a - b)^2$ (2)

iii. $\sqrt{98} + 3\sqrt{18} - 2\sqrt{12}$ (2)

iv. $(2\sqrt{3} + 3\sqrt{2})^2$ (2)

8. i. Rationalise the denominator of $\frac{3}{3 - \sqrt{2}}$ (2)

ii. Hence find m and n such that $\frac{3}{3 - \sqrt{2}} = m + n\sqrt{2}$ (2)

9. Solve these for x :

i. $(x-4)(3-x)(2x+5)=0$ (2)

ii. $5x = 18 - 2x^2$ (2)

iii. $\frac{2}{x-3} = \frac{1}{x+4}$ (2)

iv. $(4+3x) < -\frac{5x}{2}$ (2)

v. $\sqrt{1+x^2} = 1+x$ (2)

vi. $|3-4x| = 5x$ (3)

10. Solve $(3x) = 2 + \frac{2}{x}$ (leaving your answer in simplest exact form) (3)

11. Fully simplify these :

i. $\frac{k^2 - 1}{1 - k}$ (2)

ii. $\frac{6}{x^3 + 125} \div \frac{3}{x + 5}$ (2)

iii. $\frac{2}{x^2 - 1} + \frac{1}{x^2 + x}$ (3)

iv. $\frac{\sqrt{x} + \frac{1}{\sqrt{x}}}{x^2 - 1}$ (3)

12. Solve these equations simultaneously :

i. $3x = 11 + y$ and $8x + 3y = 18$ (3)

ii. $y = x^2 - 4x$ and $3x - y - 12 = 0$ (3)



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1. Evaluate $\frac{\pi + \sqrt{6.85}}{60\%}$ to 2 decimal places. (2)

9.60
Mark:
* 9.6
or * 9.598071865...
* 7.50 (did not use brackets in numerator)

2. The distance from Sun to the Earth is 149 494 000 km. Write this in scientific notation correct to 3 significant figures. (2)

1.49 x 10⁸
Mark:
* $\square \times 10^8$
↑
anything between 1 and 9.99...

3. A car is sold for \$24300, which is a profit of 8% on its cost price. Find its cost price to the nearest dollar. (2)

100% 8%
← \$24300 →
Mark:
* \$225
* \$26413
108% = \$24300
1% = \$225
100% = \$22500

4. If $x = \sqrt{a}$, find the value of $6a$ in terms of x . (1)

$x^2 = a$
 $\therefore 6a = \underline{6x^2}$

5. How many times must the number k be added to the number p to give a total of $4p + 3k$? (2)

$nk + p = 4p + 3k$ ← Mark
 $nk = 3p + 3k$
 $n = \underline{\frac{3p + 3k}{k}}$

6. Fully factorise these

i. $4m^2 - 19m + 12$ (2)
 $\begin{matrix} 4m & -3 \\ m & -4 \end{matrix}$ $(4m-3)(m-4)$
Mark:
* $(4m-4)(m-3)$
or * $(4m-3)---$
or * $(m-4)---$

ii. $4x + 12y - xz - 3yz$ (2)
 $4(x+3y) - z(x+3y)$ ← Mark
 $(x+3y)(4-z)$
or Mark:
* $(x+3y)---$
* $(4-z)---$

iii. $48 - 27m^2$ (2)
 $3(16 - 9m^2)$
 $3(4-3m)(4+3m)$
Mark:
* $3()$
or * $(4-3m)---$
or * $(4+3m)---$

7. Simplify fully

i. $(3x-4)(4x+2x^2-5)$ (2)
 $12x^2 + 6x^3 - 15x - 16x - 8x^2 + 20$
 $6x^3 + 4x^2 - 31x + 20$
Mark:
* correct first line expansion
or * correct simplification

ii. $(a+b)^2 - (a-b)^2$ (2)
 $a^2 + 2ab + b^2 - [a^2 - 2ab + b^2]$
 $a^2 + 2ab + b^2 - a^2 + 2ab - b^2$
 $4ab$
Mark:
* $2b^2$ (ignored brackets)
or * correct simplification

iii. $\sqrt{98} + 3\sqrt{18} - 2\sqrt{12}$ (2)
 $\sqrt{49 \times 2} + 3\sqrt{9 \times 2} - 2\sqrt{4 \times 3}$
 $7\sqrt{2} + 9\sqrt{2} - 4\sqrt{3}$
 $16\sqrt{2} - 4\sqrt{3}$
Mark:
* any 2 correct surd simplifications
or * correct simplification

iv. $(2\sqrt{3} + 3\sqrt{2})^2$ (2)
 $4\sqrt{9} + 2 \times 2\sqrt{3} \times 3\sqrt{2} + 9\sqrt{4}$
 $12 + 12\sqrt{6} + 18$
 $30 + 12\sqrt{6}$
Mark:

8. i. Rationalise the denominator of $\frac{3}{3-\sqrt{2}} \times \frac{3+\sqrt{2}}{3+\sqrt{2}}$ (2)
 $\frac{9+3\sqrt{2}}{9-2}$
 $= \frac{9+3\sqrt{2}}{7}$
Mark:
* multiply by $\frac{3+\sqrt{2}}{3+\sqrt{2}}$

ii. Hence find integers m and n such that $\frac{3}{3-\sqrt{2}} = m + n\sqrt{2}$ (2)
 $m = \frac{9}{7}, n = \frac{3}{7}$
(Mark each)
or correct from (i) | Mark:
 $m = 9$ and $n = 3$

9. Solve these for x:

i. $(x-4)(3-x)(2x+5)=0$ (2)

$x=4$ $x=3$ $x=-2.5$

1 mark: * any correct 2 answers

ii. $5x=18-2x^2$ (2)

$2x^2+5x-18=0$

$2x^2+9x-4$
 $x \rightarrow -2$

$(2x+9)(x-2)=0$

$x=-\frac{9}{2}$ or $x=2$

1 mark:
 $(2x+9)(x-2)=0$
Completing the square.
Quadratic formula

iii. $\frac{2}{x-3} = \frac{1}{x+4}$ (2)

$2(x+4) = 1(x-3)$

$2x+8 = x-3$

$x = -11$

iv. $4+3x < -\frac{5x}{2}$ (2)

$8+6x < -5x$

$11x < -8$

$x < -\frac{8}{11}$

v. $\sqrt{1+x^2} = 1+x$ (2)

$1+x^2 = (1+x)^2$

$1+x^2 = 1+2x+x^2$

$2x = 0$

$x = 0$

vi. $|3-4x| = 5x$ (3)

$3-4x = 5x$

$3-4x = -5x$

$9x = 3$

$x = -3$

$x = \frac{1}{3}$

Test:

$|3-4x-3| = 5x-3$

$15 = -15$

Reject.

Test:

$|3-4x\frac{1}{3}| = 5x\frac{1}{3}$

$|\frac{2}{3}| = |\frac{5}{3}|$

Accept

* 2 marks: No test

* 1 mark: $x = \frac{1}{3}$

10. Solve $3x = 2 + \frac{2}{x}$ (leaving your answer in simplest exact form) (3)

$3x^2 = 2x + 2$

$3x^2 - 2x - 2 = 0$

$x = \frac{2 \pm \sqrt{(2)^2 - 4 \times 3 \times -2}}{2 \times 3}$

$= \frac{2 \pm \sqrt{28}}{6}$

$= \frac{2 \pm \sqrt{4 \times 7}}{6}$

$= \frac{2 \pm 2\sqrt{7}}{6}$

$= \frac{2(1 \pm \sqrt{7})}{6}$
 $= \frac{1 \pm \sqrt{7}}{3}$

1 mark:
* correct substitution into formula

2 marks:
* $\frac{2 \pm \sqrt{28}}{6}$

11. Simplify these:

i. $\frac{k^2-1}{1-k}$ (2)

$\frac{(k-1)(k+1)}{1-k}$
 $= \underline{\underline{-(k+1)}}$

1 mark:
* correctly factorise the top.

ii. $\frac{6}{x^3+125} + \frac{3}{x+5}$ (2)

$\frac{6}{(x+5)(x^2-5x+25)} + \frac{3}{x+5}$
 $= \frac{2}{x^2-5x+25}$

1 mark:
* correctly factorise x^3+125

iii. $\frac{2}{x^2-1} + \frac{1}{x^2+x}$ (3)

$\frac{2}{(x-1)(x+1)} + \frac{1}{x(x+1)}$
 $\frac{2x + 1x(x-1)}{x(x+1)(x-1)}$

$\frac{2x+x-1}{x(x+1)(x-1)}$

$\frac{3x-1}{x(x+1)(x-1)}$

1 mark:
* factorising both denominator

2 marks:
* LCD $x(x+1)(x-1)$

iv. $\frac{\sqrt{x} + \frac{1}{\sqrt{x}}}{x^2-1}$ (3)

$\frac{x+1}{\sqrt{x}} \div \frac{1}{\sqrt{x}}$
 $\frac{x+1}{x^2-1}$

$\frac{x+1}{\sqrt{x}} \div \frac{(x+1)(x-1)}{1}$

$\frac{x+1}{\sqrt{x}} \times \frac{1}{(x-1)(x+1)}$

$\frac{1}{\sqrt{x}(x-1)}$

1 mark:
* factorise x^2-1
or * $\frac{x+1}{\sqrt{x}}$ (or equivalent)

2 marks:
* both of above

12. Solve these equations simultaneously:

i. $3x = 11 + y$ and $8x + 3y = 18$ (3)

$y = 3x - 11$

$8x + 3(3x - 11) = 18$

$8x + 9x - 33 = 18$

$17x = 51$

$x = 3$

$y = -2$

1 mark:

* correctly substitutes (must be shown) to get 2nd letter

* correctly eliminates one letter to form an equation.

2 marks:

* $x = 3$
or * $y = -2$

ii. $y = x^2 - 4x$ and $3x - y - 12 = 0$ (3)

sub ① in ②

$3x - (x^2 - 4x) - 12 = 0$

$3x - x^2 + 4x - 12 = 0$

$x^2 - 7x + 12 = 0$

$(x-4)(x-3) = 0$

$x = 4$ $x = 3$

$y = 0$ $y = -3$

1 mark

* correctly substitutes (must be shown) to get 2nd letter
* forms a quadratic

2 marks

* $x = 4, x = 3$
or * $y = 0, y = -3$