NORMANHURST BOYS HIGH SCHOOL

STAGE 5.1-5.3 MATHEMATICS

2016 Year 9 Yearly Examination

Thursday, 3 November 2016

General instructions

- Working time – 55 minutes.
- Write using blue or black pen. Where diagrams are to be sketched, these may be done in pencil.
- Board approved calculators may be used.
- Attempt all questions.
- At the conclusion of the examination, bundle any additional sheets used in the correct order within this paper and hand to examination supervisors.

Class: (please ✓)

- ○ 9MAT.B – Mrs Bhamra/Miss Park
- ○ 9MAT.G – Mrs Gan
- ○ 9MAT.L – Mr Lam
- ○ 9MAT.R – Dr Lawson

NAME: .....

Marker's use only

SECTION	1	2	3	4	5	6	Total	%
MARKS	/15	/9	/7	/6	/9	/17	/63	

SECTION 1 (15 marks)

1. Write without fractional or negative indices: 2

$$\left(\frac{a^2}{25}\right)^{-\frac{3}{2}}$$

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2. Rationalise the denominator, expressing it in simplest form: 3

$$\frac{1}{3\sqrt{2}+2\sqrt{3}}$$

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3. Fully factorise the following: 3

a. $a^2 - a + 2ab - 2b$

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b. $2x^2 - 13x + 15$ 2

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4. Write m as the subject of the formula if 2

$$T = \frac{m}{1+\ m}$$

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5. A rectangle is to be constructed with dimensions x cm and $(x-7)$ cm. The perimeter of the rectangle is to be less than 34 cm. What are the possible values for x? 3

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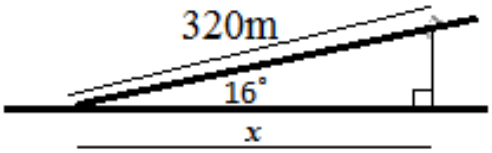
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SECTION 2 (9 marks)

6. A car travelled 320 m along a road that rises steadily at an angle of 16° to the horizontal. 2



Calculate the horizontal distance through which the car has travelled (given by x).

Give your answer correct to 2 decimal places.

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7. A fire observation tower P in a national park is 10 km away from the ranger headquarters R on a bearing of 308° T.

   A second tower Q is 24 km from headquarters on a bearing of 038°T.

   a. Draw a diagram to represent this information. 1

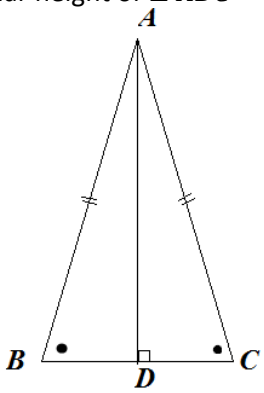
   b. Hence, find the distance between the two towers. 2

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8. In $\triangle ABC$, $AB = AC$. AD is the perpendicular height of $\triangle ABC$



   a. Prove that $\Delta ABD \equiv \Delta ACD$ 3

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   b. Hence show that AD bisects BC. 1

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SECTION 3 (7 marks)

9. The mean of a set of nine scores is 24. When another score is added to the set, the new mean is 22.5. Find the value of the score that was added. 2

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10. The following set of data describes the number of cars parked on a street for 15 days:

$$13, 14, 15, 16, 17, 26, 26, 27, 30, 35, 37, 39, 39, 41, 45$$

   a. Find the median. 1

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   b. Find the lower quartile. 1

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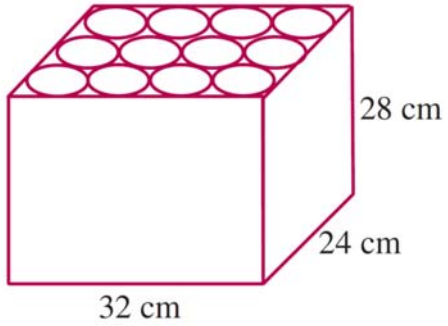
   c. Find the upper quartile. 1

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   d. Draw a box plot to represent this data 2

SECTION 4 (6 marks)

11. A box contains 24 cans of Cola. There are two layers of cans and each layer holds 3 rows of 4 cans. The box is 32 cm long, 24 cm wide and 28 cm high.



a. Find the height and radius of each can. 2

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b. Find the total volume of Cola in the box, giving your answer in exact form. 2

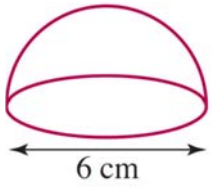
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12. Find the surface area of the hemisphere in terms of π. 2



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SECTION 5 (9 marks)

13. State the y-intercept and the gradient of the line 2

$$y = -2(5 - 7x)$$

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14. M is halfway between point $A(-13, 7)$ and the point $B\ (11, -3)$. Find the distance of M from B? 2

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15. Find the equation of a line that passes through the points $(2, 3)$ and $(4, 5)$. 3

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16. Find the equation of a line that is parallel to the line $3x - y - \ 4 = 0$ and has y-intercept of 3. 2

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SECTION 6 (17 marks)

17. John is offered a sales position with a basic wage of $350 per week plus a commission of 7% on sales. 3

    If John sells $4865 worth of goods, what would be his income for the week?

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18. Anna works in a supermarket on a casual basis. She is paid $16.80/hr from Monday to Friday and time-and-a-half on Saturdays. 2

    Find her weekly income if she works from 3.30pm - 7.30 pm Monday to Friday and from 8.00 am - 1.30 pm on Saturday.

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19. Alan received a salary of $57682 and a total of $594 from other investments. His total tax deductions were $1150.

    During the year he has already paid PAYG tax instalments amounting to $10701.75.

    Find:

    a. His taxable income 1

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    b. The tax payable given the following tax table: 2

Taxable Income	Tax on this income
0 – $18,200	NIL
$18,201 – $37,000	19c for each $1 over $18,200
$37,001 – $80,000	$3,572 plus 32.5c for each $1 over $37,000
$80,001 – $180,000	$17,547 plus 37c for each $1 over $80,000
$180,001 and over	$54,547 plus 45c for each $1 over $180,000

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    c. Medicare levy (2% of his taxable income) 1

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    d. Tax refund due or balance payable when the 2% Medicare levy is included 2

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    e. How much extra net income would he receive each week if he was given a wage rise of $10 per week? 2

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17 $\$32000$ is invested for 5 years at 8% p.a. compounded annually. 2

a. Find the total interest earned over the five years, correct to the nearest cent.

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b. Find the equivalent rate of simple interest, correct to 2 decimal places, that would earn the same amount of interest at the end of the 5 years. 2

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END OF PAPER

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SECTION 1 (15 marks)

1. Write without fractional or negative indices: 2

$$\left(\frac{a^2}{25}\right)^{-\frac{3}{2}}$$

$\left(\frac{a^2}{25}\right)^{-\frac{3}{2}} = \left(\frac{25}{a^2}\right)^{\frac{3}{2}}$

$= \left(\frac{5}{a}\right)^3$

$= \frac{125}{a^3}$

2. Rationalise the denominator, expressing it in simplest form: 3

$$\frac{1}{3\sqrt{2}+2\sqrt{3}}$$

$\frac{1}{3\sqrt{2}+2\sqrt{3}} \times \frac{3\sqrt{2}-2\sqrt{3}}{3\sqrt{2}-2\sqrt{3}}$

$= \frac{3\sqrt{2}-2\sqrt{3}}{9(4)-4(3)}$

$= \frac{3\sqrt{2}-2\sqrt{3}}{24}$

$= \frac{\sqrt{2}}{8} - \frac{\sqrt{3}}{12}$

3. Fully factorise the following: 3

a. $a^2 - a + 2ab - 2b$

$= a(a-1) + 2b(a-1)$

$= (a-1)(a+2b)$

b. $2x^2 - 13x + 15$ 2

$2x \times -3$

$x \times -5$

$(2x-3)(x-5)$

4. Write m as the subject of the formula if 2

$$T = \frac{m}{1+m}$$

$T(1+m) = m$

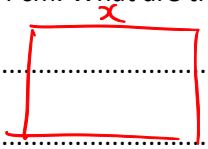
$T + mT = m$

$m - mT = T$

$m(1-T) = T$

$m = \frac{T}{1-T}$

5. A rectangle is to be constructed with dimensions x cm and $(x-7)$ cm. The perimeter of the rectangle is to be less than 34 cm. What are the possible values for x? 3



$2x + 2(x-7) < 34$

$2x + 2x - 14 < 34$

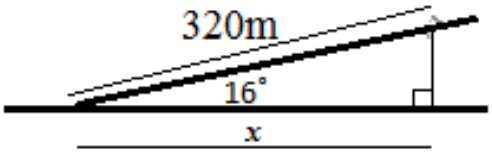
$4x < 48$

$x < 12$

$(7 < x < 12)$

SECTION 2 (9 marks)

6. A car travelled 320 m along a road that rises steadily at an angle of 16° to the horizontal. 2



Calculate the horizontal distance through which the car has travelled (given by x).

Give your answer correct to 2 decimal places.

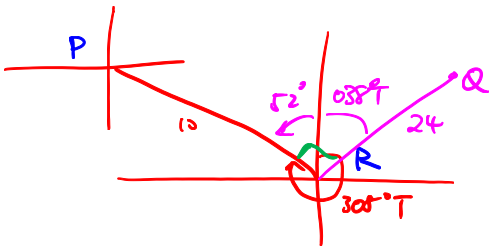
$\frac{x}{320} = \cos 16^\circ$

$x = 307.60$

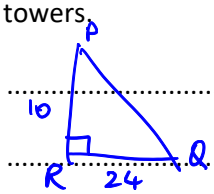
7. A fire observation tower P in a national park is 10 km away from the ranger headquarters R on a bearing of 308° T.

A second tower Q is 24 km from headquarters on a bearing of 038°T.

a. Draw a diagram to represent this information. 1



b. Hence, find the distance between the two towers. 2

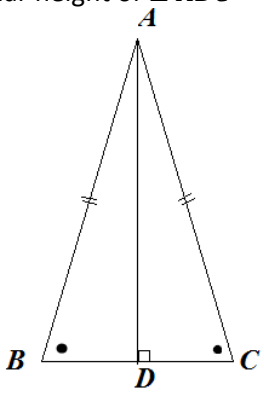


$PQ^2 = 10^2 + 24^2$

$= 26^2$

$PQ = 26$

8. In $\triangle ABC$, $AB = AC$. AD is the perpendicular height of $\triangle ABC$



a. Prove that $\Delta ABD \equiv \Delta ACD$ 3

1.) AD (common)

2.) AB = AC (given)

3.) $\angle ADC = \angle ADB = 90^\circ$ (given)

$\therefore \Delta ABD \equiv \Delta ACD$ (RHS)

b. Hence show that AD bisects BC. 1

$\therefore BD = BC$ (corresponding sides of congruent Δ)

$\therefore AD$ bisects BC.

SECTION 3 (7 marks)

9. The mean of a set of nine scores is 24. When another score is added to the set, the new mean is 22.5. Find the value of the score that was added. 2

$\frac{x_1 + x_2 + \ldots + x_9}{9} = 24$

$x_1 + x_2 + \ldots + x_9 = 216$

$\frac{x_1 + x_2 + \ldots + x_9 + x_{10}}{10} = 22.5$

$216 + x_{10} = 225$

$x_{10} = 9$.

10. The following set of data describes the number of cars parked on a street for 15 days:

13, 14, 15, 16, 17, 26, 26, 27, 30, 35, 37, 39, 39, 41, 45

a. Find the median. 1

27.

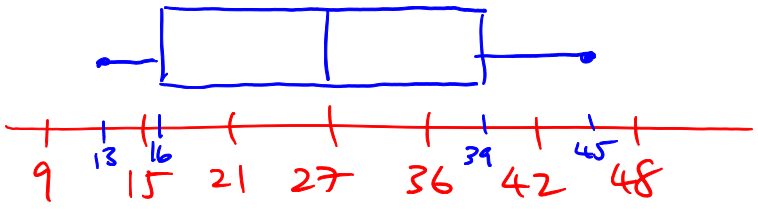
b. Find the lower quartile. 1

16

c. Find the upper quartile. 1

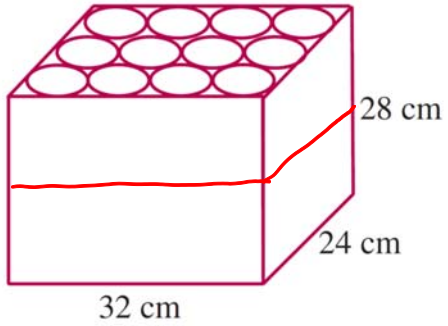
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d. Draw a box plot to represent this data 2



SECTION 4 (6 marks)

11. A box contains 24 cans of Cola. There are two layers of cans and each layer holds 3 rows of 4 cans. The box is 32 cm long, 24 cm wide and 28 cm high.



a. Find the height and radius of each can. 2

height = 14cm.

diameter = $\frac{32}{4}$ = 8

radius = 4 cm.

b. Find the total volume of Cola in the box, giving your answer in exact form. 2

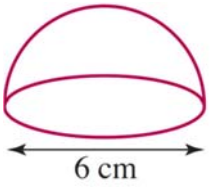
$V = \pi r^2 h$ (one can)

$= \pi \times 4^2 \times 14 = 224\pi$

Total volume $= 32 \times 224\pi$

$= 7168\pi$

12. Find the surface area of the hemisphere in terms of π. 2



$SA = 4\pi r^2$ (sphere)

$SA_{curved} = 2\pi r^2 = 2\pi \times 3^2 = 18\pi$

$SA_{bottom} = \pi r^2 = \pi \times 3^2 = 9\pi$

$SA_{TOTAL} = 27\pi$

SECTION 5 (9 marks)

13. State the y-intercept and the gradient of the line 2

$$y = -2(5 - 7x)$$

$y = 14x - 10$

$m = 14$ $b = -10$

14. M is halfway between point $A(-13, 7)$ and the point $B\ (11, -3)$. Find the distance of M from B? 2

$AB = \sqrt{(11+13)^2 + (-3-7)^2}$

$= \sqrt{24^2 + 10^2}$

$= 26$

$\therefore MB = 13.$

15. Find the equation of a line that passes through the points $(2, 3)$ and $(4, 5)$. 3

$\frac{y-3}{x-2} = \frac{5-3}{4-2} = 1$

$y - 3 = x - 2$

$y = x + 1$

16. Find the equation of a line that is parallel to the line $3x - y - 4 = 0$ and has y-intercept of 3. 2

$y = 3x - 4$

$\therefore y = 3x + 3.$