Class	Full Name	Index Number

PRELIMINARY EXAMINATION

2010

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bowen
SECONDARY

I believe, therefore I am

MATHEMATICS
Paper 1
Secondary 4 Express/ 4A1/ 5 Normal Academic

2 September 2010   **2 hours**

INSTRUCTIONS TO CANDIDATES

1. Write your name, class and register number in the spaces provided.

2. Answer **all** questions in this paper. Write all answers clearly in the space provided.

3. Use of electronic calculator is allowed in this paper.

4. If working is needed for any question, it must be neatly and clearly shown in the space below that question. Omission of essential working will result in loss of marks.

5. You should not spend too much time on any one question.

INFORMATION FOR CANDIDATES

1. The number of marks is given in brackets [ ] at the end of each question or part question.

2. The total mark for this paper is **80**.

DO NOT OPEN THIS PAPER UNTIL YOU ARE TOLD TO DO SO

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Setter: Ms Angie Goh

Mathematical Formulae

Compound interest

$$\text{Total amount} = P\left(1 + \frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2}ab\sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

Answer **ALL** questions

1   (a) Calculate $\dfrac{\sqrt{462.5} \times 39.5}{76.23 - 4.08^2}$, showing all the figures on your calculator display.

(b) Give your answer correct to 1 decimal place.

Answer : (a) _____ [1]

(b) _____ [1]

2   (a) Factorize $16m^4 - p^4$ completely.

(b) Expand and simplify $(-2x + 3y)(-7y - 5x)$.

Answer : (a) _____ [2]

(b) _____ [2]

3   Given that y is inversely proportional to $(x^2 + 3)$ and the difference in the values of y when

$x = 1$ and when $x = 3$ is 3,

(a) express y in terms of x ,

(b) find the value of y when $x = 5$.

Answer : (a) _____ [2]

(b) _____ [1]

4   (a) The storage capacity of an external hard disk is 250 gigabytes. How many documents can be stored if the average file size of a document is 178 megabytes? Give your answer in standard form in three significant figures.

     (b) Shawn invests $ 87 700 in a finance company that pays 2.8% compound interest per annum compounded semi-annually. Find the total amount of money Shawn received at the end of 90 months.

Answer : (a) _____ [1]

(b) $_____ [2]

5   Consider the sequence   2, 6, 12, 20, 30, 42, ……………

     (a)   Evaluate the 7th term of the sequence.

     (b)   Write down, in terms of n, an expression for the nth term of the sequence.

Answer : (a) _____ [1]

(b) _____ [2]

4

6   (a)   Given that $p\sqrt{\dfrac{p^2-q}{q}} = \dfrac{1-p}{2}$, express q in terms of p.

   (b)(i) Express $\left(\dfrac{x^{2n}y^{n-1}}{x^{n-1}y}\right)^{-2}$ in the form $x^a y^b$,

   (ii) write down $\dfrac{a}{b}$ in terms of n.

Answer : (a) _____ [3]

(b)(i) _____ [2]

(ii) _____ [2]

5

7   The area of a plot of land is 175 km^2 and is represented by an area of 7 cm^2 on a map. Find the length in cm of a line on the map which represents a 50 km expressway.

Answer : _____ cm [2]

8   Given that $2x-8<13\le 3x-10$, find the

(a)   smallest rational value of x,

(b)   largest integer value of x.

Answer : (a) _____ [1]

(b)_____ [1]

9   Expressed as the product of prime factors,

$$240 = 2^4 \times 3 \times 5 \quad \text{and} \quad 2750 = 2 \times 5^3 \times 11.$$

Use these results to find

(a) the largest integer which is a factor of both 240 and 2750,

(b) the smallest positive integer k for which 240k is a multiple of 2750.

Answer :   (a) _____ [1]

(b) _____ [1]

6

10 (a) Calculate the exterior angle of a regular 12-sided polygon.

(b) The diagram shows an incomplete figure made up of a square, a regular hexagon and another polygon of n sides. Find the value of n.
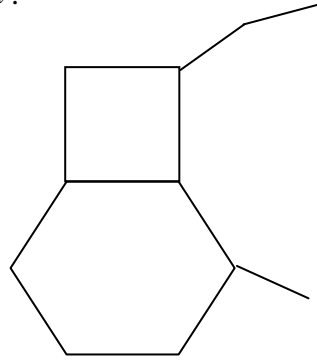
Answer : (a) _____° [1]

(b) _____ [2]

11 (a) Suppose ε is the set of quadrilaterals, P is the set of parallelograms, R is the set of rectangles and S is the set of squares. Illustrate with a Venn diagram, the sets ε, P, R and S.

[2]

(b) $\varepsilon = \{x : x < 15, x \text{ is a positive integer}\}$
    $A = \{x : 2x \le 21\}$ and $B = \{x : 2x > 7\}$

Find

(i) $n(A \cap B)'$,

(ii) $n(A \cup B)'$.

Answer : (b)(i) _____ [2]

(ii) _____ [1]

7

12 The following data represents the number of 50-metre laps Vivien had swum in a month while training for the Inter-School Championship.

15	20	27	12	25	30	23	17	22	12
30	12	35	36	21	35	12	27	29	23
26	31	20	15	30	12	32	25	18	36

(a) Represent the above data in a stem and leaf diagram.   [2]

Stem | Leaf

(b) For this distribution, find the

   (i) mode,

   (ii) median.

(c) Find the percentage of days when she swam less than 30 laps.

Answer :   (b)(i) _____ [1]

(ii) _____ [1]

(c)   _____% [1]

8

13 (a) (i) Sketch the graph of $y = x(5 + x)$.

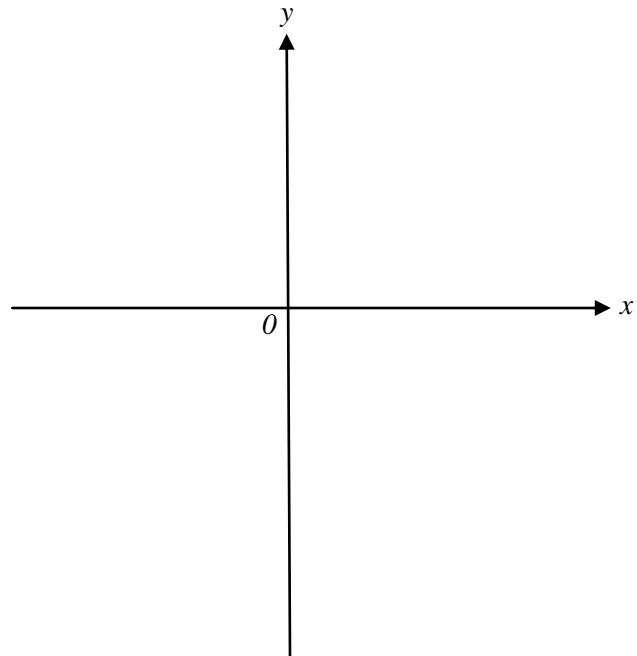(ii) Write down the equation of the line of symmetry of $y = x(5 + x)$.

Answer (a)(i)
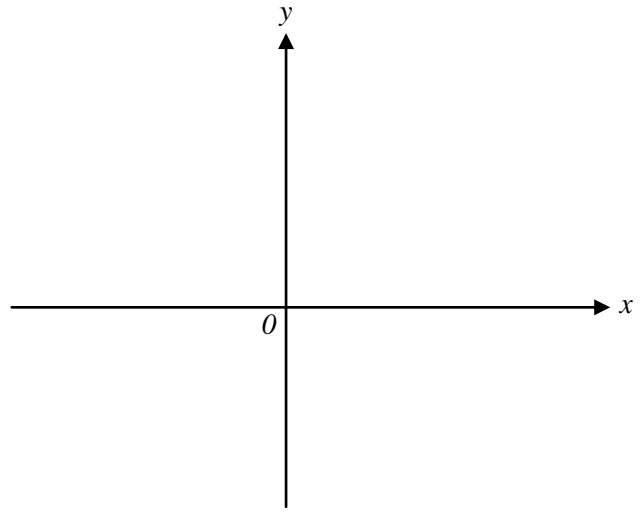
[2]

(ii)_____ [1]

(b) (i) Sketch the graph of $y = -x^2 - 6x - 15$.

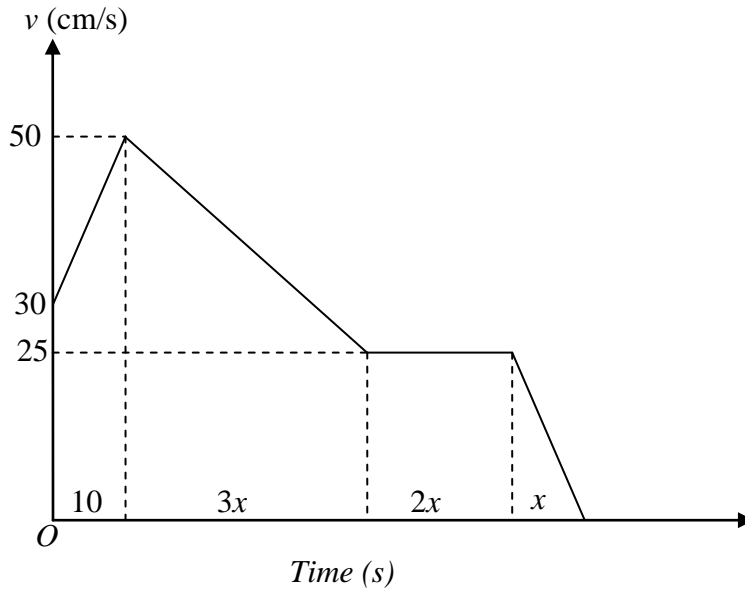(ii) Write down the coordinates of the maxmum point of the curve.
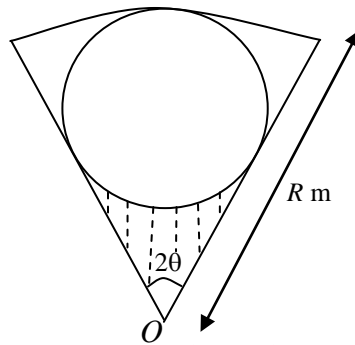
Answer (b)(i)

[2]

(ii) (_____ , _____) [1]

14 The diagram shows the speed-time graph of a remote-controlled toy car. Given that the total distance travelled during this period is 21.5 m, find

(a) the acceleration of the toy car during the first 10 seconds,

(b) the value of x,

(c) the speed of the toy car at $t = 25\,s$,

(d) the average speed of the toy car.

Answer : (a) _____ cm/s^2 [1]

(b) _____ [2]

(c) _____ cm/s [2]

(d) _____ cm/s [2]

10

The diagram shows a school compound in the form of a sector of a circle, centre O, radius R m and angle 2θ. Within this compound, a circular plot of the largest possible size is to be planted with flowers. Given that the radius of this plot is r m,

(a) show that $R = r\left(1 + \dfrac{1}{\sin \theta}\right)$.

Given also that $\theta = 30°$. When the circular plot has been constructed, the remainder of the compound consists of three regions that will be planted with herbs.

(b) calculate the remaining area of the compound that is to be planted with herbs in terms of π and r.

Given further that $R = 30$,

(c) calculate, to 2 decimal places, the length of fencing needed to fence along the perimeter of the shaded region.
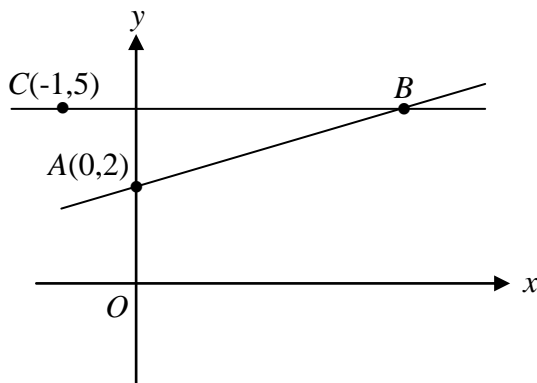
Answer : (a) _____ [3]

(b) _____ m^2 [3]

(c) _____ m [3]

16 Given that $A = \begin{pmatrix} 3 & -1 \\ 1 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & x \\ -2 & y \end{pmatrix}$, find the values of x and y if $AB = BA$.

Answer : $x =$ _____ , $y =$ _____ [3]

17 In the diagram, the gradient of the line AB is $\dfrac{1}{4}$. Find

(a) the coordinates of B,

(b) the length of AB,

(c) $\cos \angle BAO$,

(d) the area of the triangle bounded by the y-axis, the lines AB and CB.

Answer : (a) _____ [2]

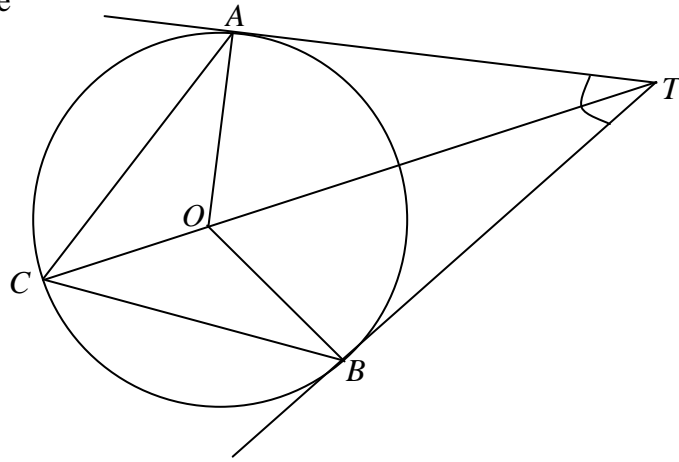(b) _____ [1]

(c) _____ [1]

(d) _____ [2]

18 In the diagram, *TA* and *TB* are tangents to the circle *ABC* whose centre is *O*. Given that

TOC is a straight line.

(a) Prove that $\triangle ACT$ is similar to $\triangle BCT$.

(b) Given that $\angle ATB = 72°$, calculate
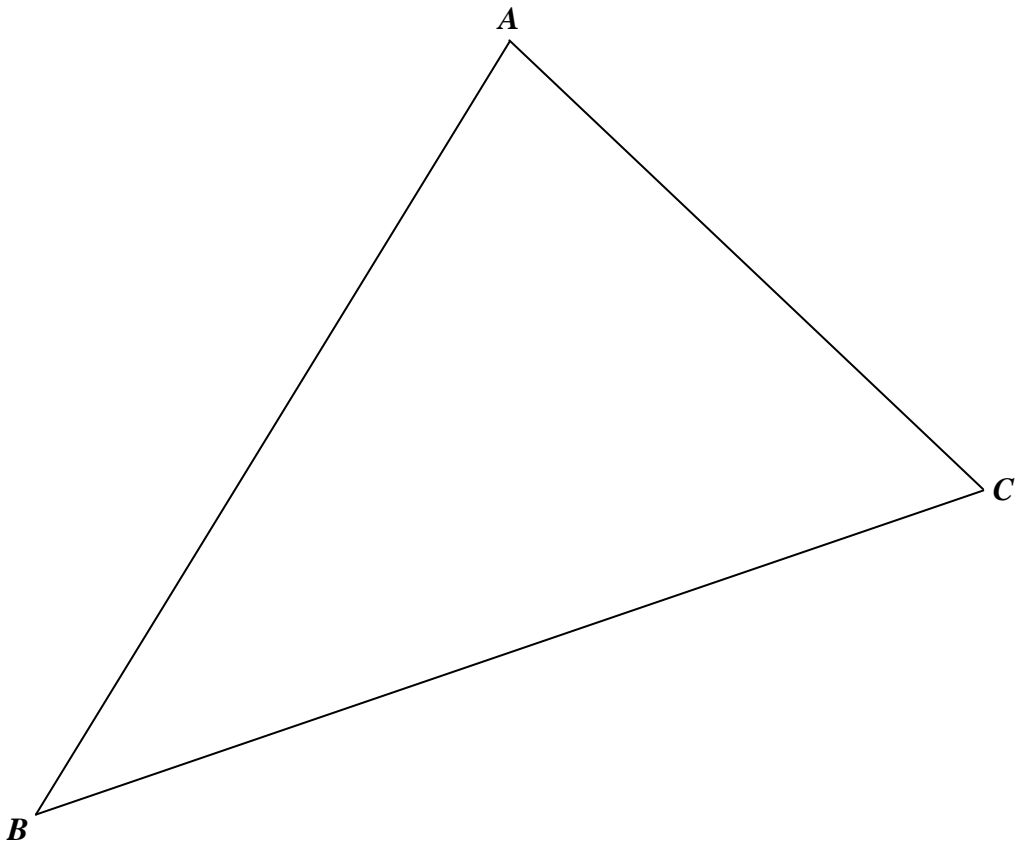
    (i) $\angle AOB$,

    (ii) $\angle CAO$.

Answer : (a) _____

_____

_____ [2]

(b)(i) _____° [1]

(ii) _____° [1]

19 The diagram shown is the scale drawing of a triangular field.

(a) Measure the angle ABC.

(b) Treasure is buried in the field and you are supposed to locate it with the following conditions.

(i) It is equidistant from AC and BC. [1]

(ii) It is also equidistant from B and C. [1]

(iii) Label the location of the treasure as "T". [1]

Answer : (a) _____ [1]

Answer Key Paper 1

1(a) 14.2569381   (b) 14.3

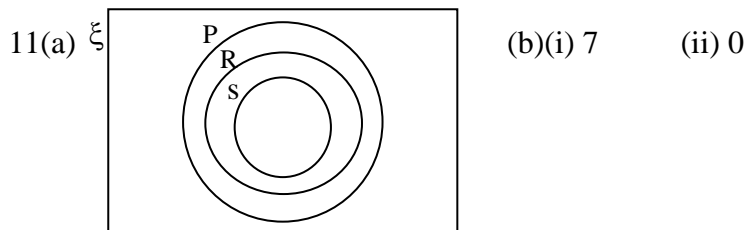2(a) $(2m - p)(2m + p)(4m^2 + p^2)$ (b) $10x^2 - xy - 21y^2$

3(a) $y = \dfrac{18}{x^2 + 3}$ (b) $y = \dfrac{9}{14}$ 4(a) 1.40×10^3 (b) \$108000

5(a) $T_7 = 56$ (b) $n(n+1)$

6(a) $q = \dfrac{4p^4}{1 - 2p + 5p^2}$ (b)(i) $x^{-2n-2}y^{-2n+4}$ (b)(ii) $\dfrac{n+1}{n-2}$

7) 10cm   8(a) $7\dfrac{2}{3}$ (b) 10

9(a) 10   (b) 275   10(a) $30°$ (b) 12 sides

11(a)   (b)(i) 7   (ii) 0

12(b)(i) 12   (ii) 24   (c) 70%

13(a)(ii) $x = -2.5$ (b)(ii) $(-3, -6)$

14(a) $2cm/s^2$ (b) $x = 10$ (c) 37.5cm/s   (d) $30\dfrac{5}{7}cm/s$

15(b) $\dfrac{1}{2}\pi r^2$ (c) $55.58m$ (16) $x = 2,\ y = -1$

17(a) (12,5)   (b) 12.4   (c) -0.243   (d) 18 sq units

18(a) SAS congruency   (b)(i) $108°$ (ii) $27°$

19(a) $40°$