School Name

Half Yearly Examination

2016

Year 10

Advanced Mathematics Course

Total Marks – 80

General Instructions

- Reading time: 5 minutes
- Working time: 2 hours
- There will be a short break between Section 1 and Section 2
- Write using black or blue pen
- You may use a pencil to draw or complete diagrams
- Attempt ALL questions
- Approved calculators may be used in Section 2.
- Write your Name and Teacher's Name in the spaces provided.
- A formula Sheet is on the reverse of this page and can be detached and used in all sections of the test.

Section 1

Non Calculator Section.

20 marks

Time allowed for this section is 30 minutes.

Write all answers in the spaces provided.

Section 2

Time allowed for this section is 1 hour and 30 minutes.

Part A

Multiple Choice Section.

Mark your answers on the separate answer sheet at the end of the examination.

40 marks

Part B

Longer Answer Section.

Write all answers in the spaces provided.

20 marks

Formula Sheet

Pythagoras' Theorem

$c^2 = a^2 + b^2$

c = hypotenuse
a and b are the shorter sides

Circumference of a circle

$C = \pi d$

d = diameter

Area of a circle

$A = \pi r^2$

r = radius

Area of a parallelogram

$A = bh$

b = base
h = perpendicular height

Area of a rhombus or kite

$A = \frac{1}{2} x y$

x and y are the diagonals

Area of a trapezium

$A = \frac{1}{2} h (a + b)$

h = perpendicular height
a and b are the parallel sides

Volume of a prism

$V = Ah$

A = area of base
h = perpendicular height

Volume of a pyramid

$V = \frac{1}{3} Ah$

A = area of base
h = perpendicular height

Volume of a cylinder

$V = \pi r^2 h$

r = radius
h = perpendicular height

Volume of a cone

$V = \frac{1}{3} \pi r^2 h$

Volume of a sphere

$V = \frac{4}{3} \pi r^3$

Surface Area of a Cylinder

$SA = 2 \pi r^2 + 2\pi r h$

Surface Area of Cone

$SA = \pi r^2 + \pi r l$

r = radius
l = slant height

Surface Area of a sphere

$V = 4 \pi r^2$

Trigonometric formulae for a triangle ABC.

Sine Rule

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

Cosine Rule

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

or

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

Area of a triangle

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

Simple interest

$I = PRT$

P = Principal
R = interest rate per time period as a decimal
T = number of time periods

Compound Interest

$A = P(1 + r)^n$

A = Final amount to which the investment grows
P = Principal
r = interest rate per compounding period as a decimal
n = number of compounding periods

Depreciation

$SV = IV(1 - r)^n$

SV = Salvage Value to which the initial value falls
IV = Initial Value
r = depreciation rate per compounding period as a decimal
n = number of compounding periods

Gradient of a line

$$m = \frac{\text{vertical rise}}{\text{horizontal run}}$$

$$= \frac{y_2 - y_1}{x_2 - x_1}$$

(x_1, y_1) and (x_2, y_2) are points on the line
m = gradient

Midpoint of a line segment

$$MP = \left(\frac{x_2 + x_1}{2}, \frac{y_2 + y_1}{2} \right)$$

Length of a line segment

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Equation of a line

$y = mx + b$

or

$y - y_1 = m (x - x_1)$

$b = y$ intercept

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Class/Teacher _____

Name_____

Section 1

20 marks
Time allowed for this section is 30 minutes

Answer Questions 1–20 in the spaces provided.

Calculators are **NOT** to be used in this section.

There will be a short break between Section 1 and Section 2.

Section 1 Non Calculator Section

Write all working and answers in the spaces provided on this test paper.

1. $(15 - 7) \times 4 = ?$

……....

……

2. $\frac{19}{20} - \frac{3}{4} = ?$

……....

……

3. What is 0.64 when written as a fraction in simplest form?

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4. The temperature at Frosty Hill was $-3°\ C$ at 4 pm and fell by $2°\ C$ every hour until 11 pm.
What was the temperature at 11 pm?

……....

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5. The Rev Heads Auto store offers a 30% discount on all stock.
What would you pay for seat covers normally priced at $120.00?

……....

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6. A survey finds that the ratio of tourists to residents in a coastal town is 4 : 15.
If there were 600 residents, how many tourists were there?

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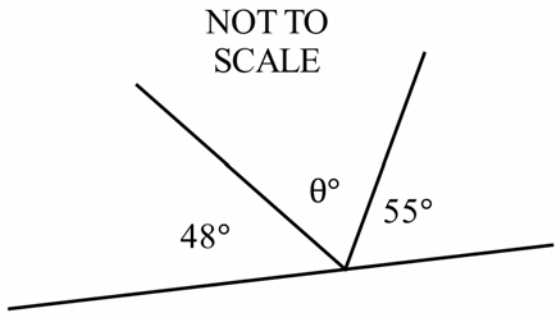
7. Find the value of θ.



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8. What is the size of $\angle CBD$?

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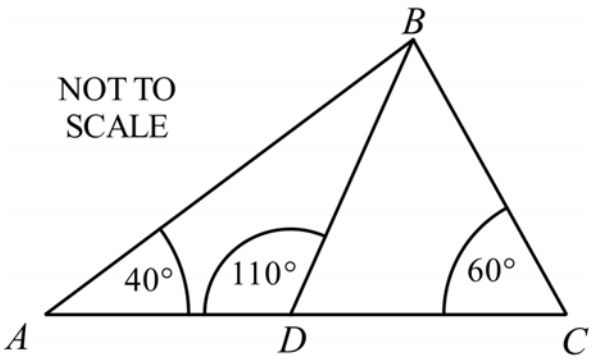
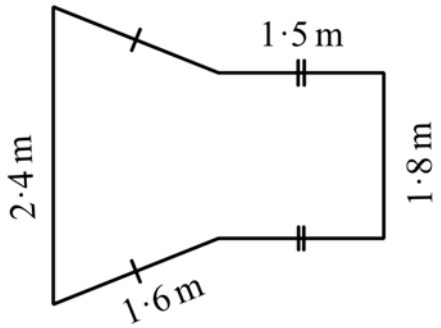


9. Find the perimeter of this hexagon.



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10. What is the area of triangle *ABC*?

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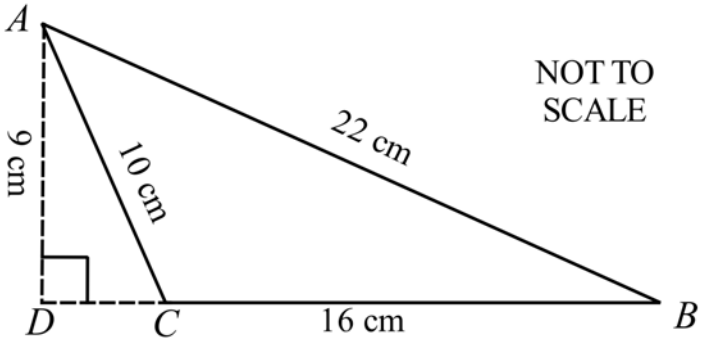
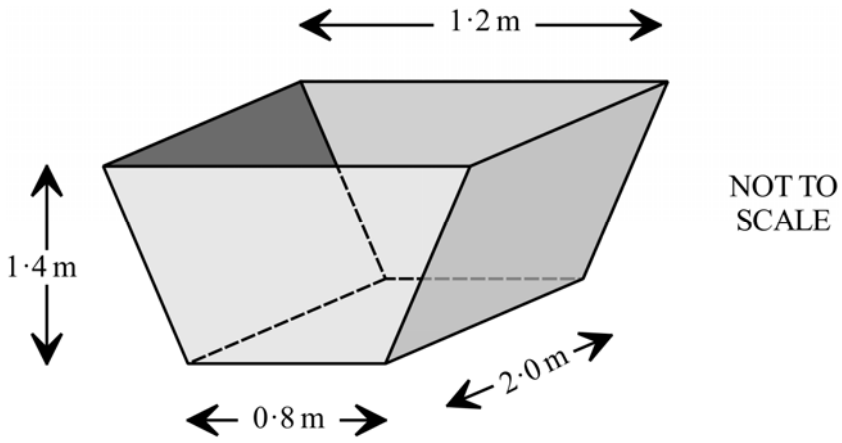


11. Calculate the volume of the trapezoidal prism.



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12. Simplify the expression $2xy + 3x \times 4y$.

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13. Simplify $\dfrac{24x^3y^4}{4x^3y}$.

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14. Expand and simplify $10x^2 - 3x(2x - 4y)$

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……

15. What are the coordinates of the midpoint of the interval joining $A(-6, 7)$ and $B(-10, -5)$?

……

……

16. The wavelength of green light is given as 5.5×10^{-7} metres.

Write this distance a normal decimal numeral, without using indices.

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17. Find the value of w if $7w + 1 = 2w - 16$.

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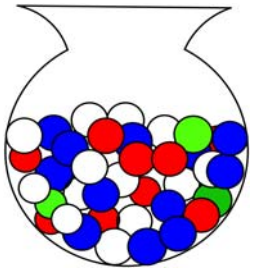
18. A vase holds 50 coloured balls. Twelve balls are red, eleven are white, seven are green and the rest are blue.

If one is chosen at random, what is the probability that it is blue?



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Questions 19 and 20 refer to the following:

0	3	4	5		
1	3	4	6	8	
2	1	2	5	6	8
3	3	6			
4	0	0	2	5	
5	0	7			

The stem and leaf plot shows the scores from throwing 20 darts at a dartboard.

19. What percentage of the scores are less than 20?

……

……

20. What is the mean of the scores?

……

……

End of Section 1

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Section 2

60 marks

Time allowed for this section is

1 hour and 30 minutes

This section has TWO parts

Part A – Forty multiple-choice questions worth 1 mark each.

Mark your answers on the separate answer sheet provided at the end of the examination.

Part B – Longer answer questions worth a total of 20 marks.
Write all answers and working in the spaces provided on this examination paper.

Calculators may be used in this section.

Do not commence Section 2 until you are instructed to do so.

Use the multiple choice answer sheet at the end of the paper to record your answers.
Complete shade the bubble corresponding to the correct answer for each question.

21. Jake is paid a normal rate of \$48.00 / hour for a 36 hour week, and time-and-a-half for all overtime.

What would Jake be paid for a week where he worked 40 hours?

A. \$1 920 B. \$1 968 C. \$2 016 D. \$2 880

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22. Andrew buys a lounge valued at \$960, on time payments.

He pays a deposit of \$120 and makes monthly payments of \$45.00 for two years.

How much interest does he pay?

A. \$120 B. \$240 C. \$960 D. \$1080

---

23. A plane flies at a speed of 640 km/h relative to the ground.

How long would a flight which is 2 400 km take?

A. 3 ½ hours B. 3 hours and 35 minutes

C. 3 hours and 40 minutes D. 3 hours and 45 minutes

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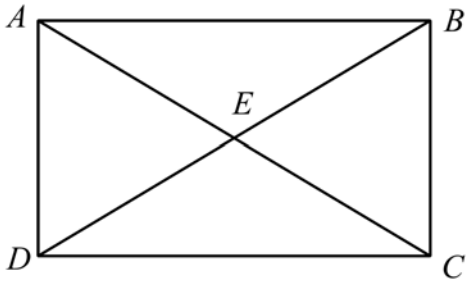
24. *ABCD* is a rectangle and its diagonals intersect at *E*.



Which triangle is congruent to Δ *ABC*?

A. Δ *ABE*. B. Δ *ADE*. C. Δ *ABD*. D. Δ *AED*.

---

25. In the diagram below, KLMN is a rectangle and P is a point on KL, such that PN = NM.

$\angle KPN = 40°$ and $\angle PML = x°$.

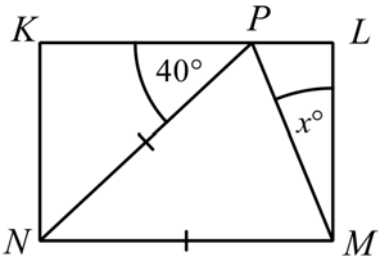
What is the value of *x*?

A. 20°

B. 40°

C. 50°

D. 70°



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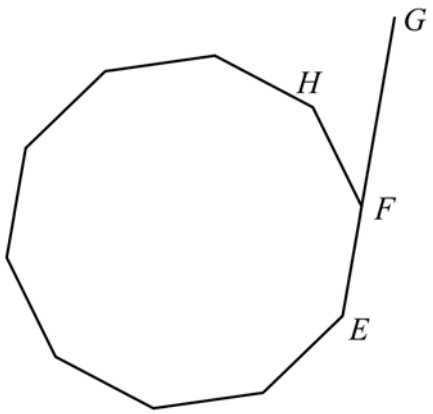
26. The side *EF* of a regular decagon is produced to a point *G*.
What is the size of $\angle HFG$?



A. 18°
B. 24°
C. 36°
D. 72°

---

27. This can of beans has a diameter of 8 cm and a height of 12 cm.
What capacity should the manufacturer print on the label of the can?

A. 450 ml
B. 600 ml
C. 750 ml
D. 2.4 litres

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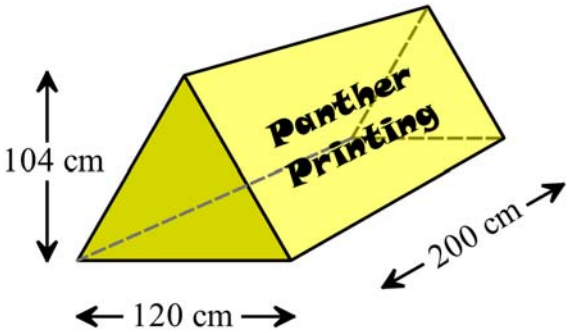
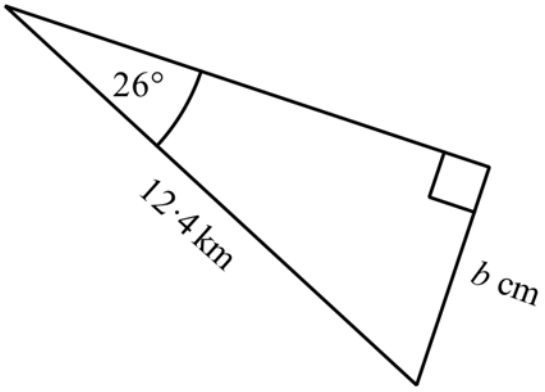
28. This sign is a prism, with an equilateral triangle as it's cross section.
It is hollow and built from sheets of plywood.
What area of plywood is used to make the sign?



A. 7.2 m^2
B. 7.8 m^2
C. 8.0 m^2
D. 8.4 m^2

---

29. What is the value of *b*?

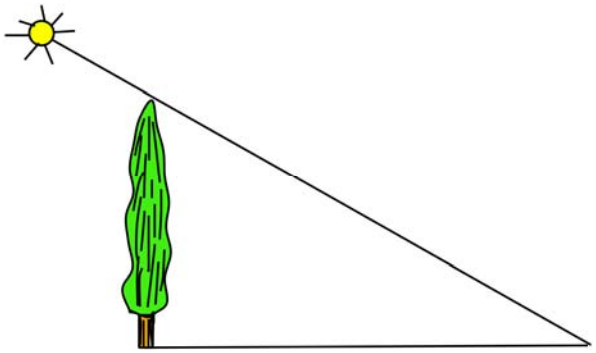


A. 5.4 km
B. 6.0 km
C. 11.1 km
D. 25.4 km

---

30. A 15 m high tree casts a shadow which is 24 m long.

What is the angle of elevation of the sun at the time?



A. 32^o

B. 39^o

C. 51^o

D. 59^o

31. The table shows the genres of books on Dean's bookshelf.

A book is chosen at random.

What is the probability that it's genre is either Crime or Thriller?

Book Genre	Frequency
Crime	23
Thriller	17
Comedy	18
Biography	8
Self Help	14

A. $\frac{17}{80}$

B. $\frac{17}{40}$

C. $\frac{1}{2}$

D. $\frac{17}{23}$

32. Which is the correct and complete factorisation of $12m^2n^3 - 16m^2n$?

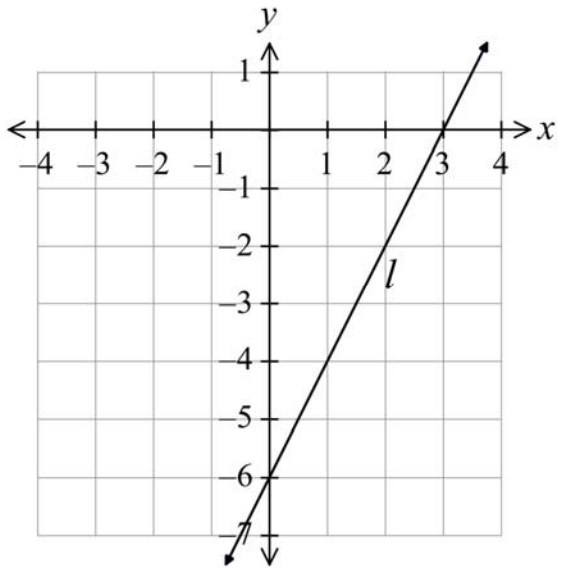
A. $2m^2(6n^3 - 8n)$

B. $4m^2n(3n^2 - 4)$

C. $4m^2(3n^3 - 4n)$

D. $12m^2n(n^2 - 4)$

Questions 33 and 34 refer to the following:



A line l has been drawn on the number plane above.

33. What is the equation of the line l ?

A. $y = \frac{1}{2}x - 3$

B. $y = \frac{1}{2}x - 6$

C. $y = 2x - 3$

D. $y = 2x - 6$

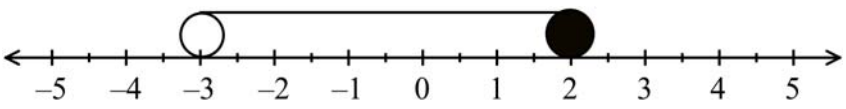
34. What is the point of intersection between the line l and the line $y = -x - 3$?

A. $(0, -6)$ B. $(1, -4)$ C. $(2, -2)$ D. $(3, 0)$

35. $(2x^3y^{-2})^3 =$

A. $\frac{6x^6}{y}$ B. $\frac{8x^9}{y^6}$ C. $\frac{8y^6}{x^9}$ D. $8x^6y$

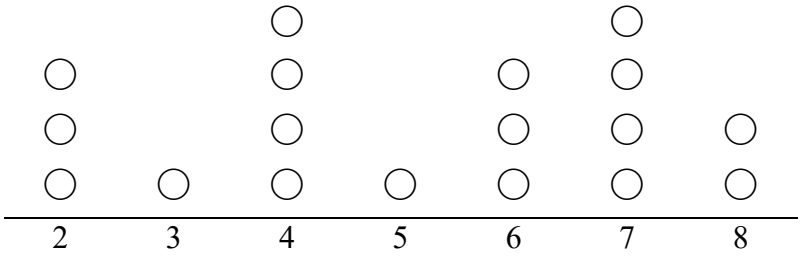
36. Which inequation describes the number line graph below?



A. $-3 < x \leq 2$ B. $-3 \leq x \leq 2$ C. $-3 \leq x < 2$ D. $-3 < x < 2$

Question 37 – 39 refer to the following:

The dot plot was constructed by a researcher observing the size of groups at tables in a restaurant.



37. Which description could be applied to the distribution?

    A. It is bimodal.
    B. It is negatively skewed.
    C. It is positively skewed.
    D. It is symmetrical.

38. The restaurant wishes to use the data in its advertising.
    Which statement drawn from the data is misleading or inaccurate?

    A. The average size of groups at our restaurant is approximately 5.
    B. The median size of groups at our restaurant is over 5.
    C. Group sizes range from couples to groups of 8 at our restaurant.
    D. The most common group size at our restaurant is 7 people.

39. The researcher draws a sector graph from the data she has collected.
    What angle would she use for the sector which represents groups of 4 people.

    A. 40^o
    B. 60^o
    C. 75^o
    D. 80^o

40. A class has 24 students and they all collected clothing for a charity drive and brought them in to school.

The number of pieces brought in by each child was recorded.

The following statistics were calculated when 22 of the students had brought in their pieces of clothing.

The least that any child brought was 9 pieces of clothing and three students brought 14 pieces.

Measure	Value
Mean	12.5
Median	11
Mode	14
Range	6

On the next day, the other two students brought in 16 pieces of clothing each.

Which of the measures above would not change when the extra two students are included?

A. The mean.

B. The median.

C. The mode.

D. The range.

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41. Quentin invests $2 400 in an account which pays 6% p.a. interest, compounded annually.

If he leaves the money in the account for 3 years, how much interest will he earn?

A. $296.64 B. $432.00 C. $458.44 D. $548.44

---

42. Four years ago, Josie bought a car for $32 500.

The depreciation rate for the car was 8.5% p.a.

What is the value of the car now, to the nearest ten dollars?

A. $21 450 B. $22 780 C. $24 900 D. $ 35 260

---

43. $a^{-\frac{2}{3}} = ?$

A. $\frac{1}{\sqrt[3]{a^2}}$ B. $\frac{1}{\sqrt{a^3}}$ C. $-\sqrt[3]{a^2}$ D. $-\sqrt{a^3}$

---

44. Simplify $\sqrt{24} + \sqrt{54}$.

A. $5\sqrt{6}$ B. $6\sqrt{5}$ C. $13\sqrt{6}$ D. $39\sqrt{6}$

---

45. Which expression is equivalent to $\dfrac{6-2\sqrt{5}}{\sqrt{5}}$?

A. $\dfrac{2\sqrt{5}-5}{5}$ B. $\dfrac{3\sqrt{5}-5}{3}$ C. $\dfrac{6-10\sqrt{5}}{5}$ D. $\dfrac{6\sqrt{5}-10}{5}$

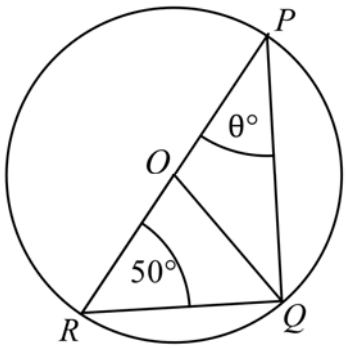
---

46. The circle has its centre at O.

P, Q and R, are points on the circumference.

RP is a diameter, $\angle PRQ = 50°$ and $\angle RPQ = \theta°$.

Find the value of θ.



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A. 25°

B. 40°

C. 50°

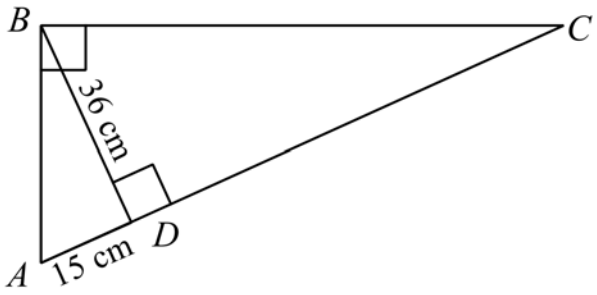
D. 80°

---

47. In the diagram $BD = 36$ cm and $AD = 15$ cm.

ΔABC is right angled at B and ΔABD is right angled at D.

Find the size of $\angle BCA$.



A. 23°

B. 25°

C. 65°

D. 67°

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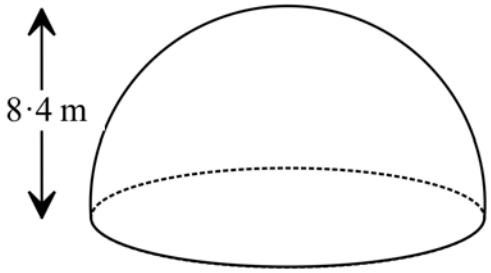
48. What is the volume of the hemisphere (correct to 3 significant figures)?



A. 443 m^3

B. 887 m^3

C. 1 240 m^3

D. 2 480 m^3

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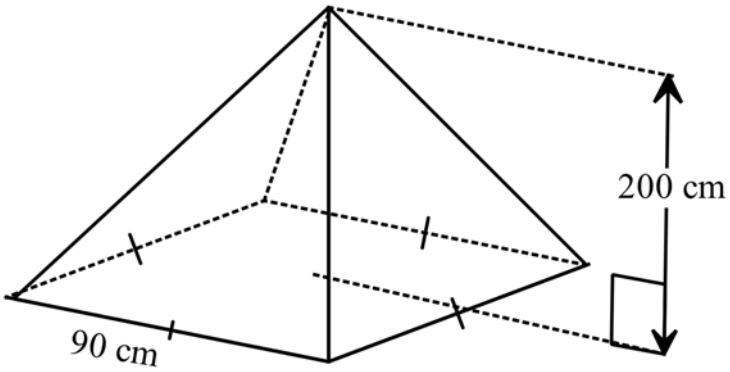
49. The square pyramid shown is made from cardboard.

What area of cardboard is used?



A. 36 000 cm^2

B. 36 900 cm^2

C. 44 100 cm^2

D. 45 000 cm^2

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50. $18x^2 - 32 =$

A. $2x\ (9x - 8)$

B. $2(3x - 4)(3x + 4)$

C. $2x(3x - 4)(3x + 4)$

D. $(9x - 16)(9x + 16)$

---

51. $\dfrac{1}{x-4} + \dfrac{2}{x-3} = ?$

A. $\dfrac{2x-7}{x^2-x-12}$ B. $\dfrac{2x-7}{x^2-7x+12}$

C. $\dfrac{3x-11}{x^2-x-12}$ D. $\dfrac{3x-11}{x^2-7x+12}$

---

52. What is the x coordinate of the solution when the pair of equations below are solved simultaneously?

$$x - 2y = 5$$
$$y = 3x - 5$$

A. $x = -2$ B. $x = -1$ C. $x = 1$ D. $x = 2$

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53. Which expression would give the solution to $3x^2 - 3x - 2 = 0$?

A. $x = \dfrac{3 \pm \sqrt{15}}{6}$ B. $x = \dfrac{3 \pm \sqrt{33}}{6}$

C. $x = \dfrac{3 \pm \sqrt{15}}{4}$ D. $x = \dfrac{3 \pm \sqrt{33}}{4}$

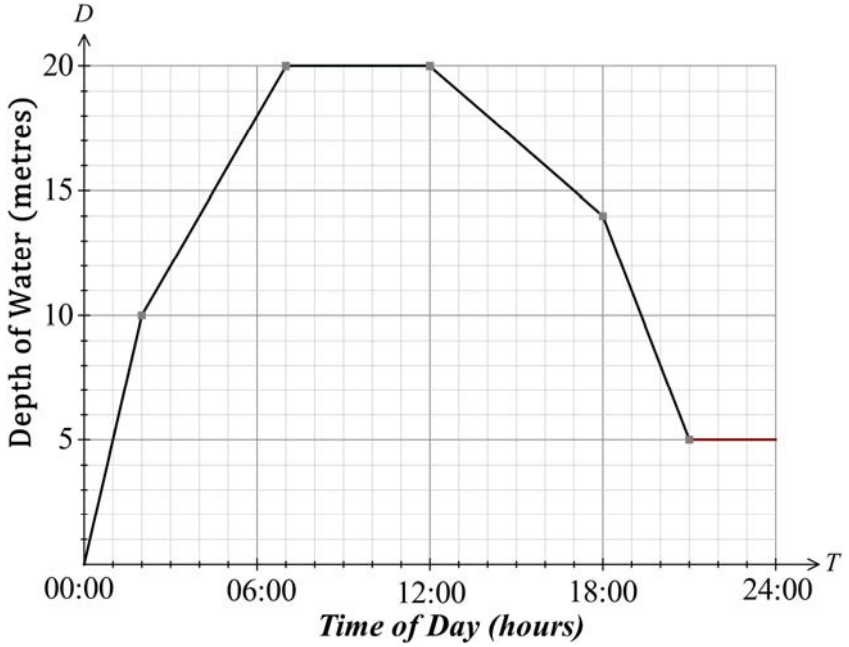
54. The graph shows the depth of water in a reservoir over a period of 24 hours.
Between which times was the depth of water changing most quickly?

A. 00:00 and 02:00

B. 02:00 and 07:00

C. 12:00 and 18:00

D. 18:00 and 21:00



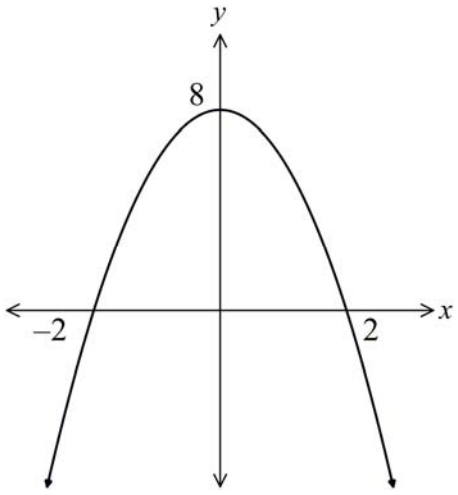
55. Which equation could describe the curve shown?

A. $y = x^2 - 8$

B. $y = 8 - x^2$

C. $y = 2x^2 - 8$

D. $y = 8 - 2x^2$



56. Two students are needed to represent the school at a ceremony.

There are four students (*A, B, C* and *D*) who wish to fill the places.

As all four are worthy applicants, the principal chooses two names at random from the four.

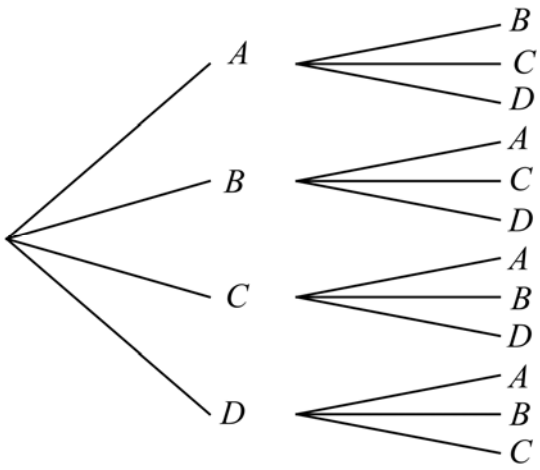
What is the probability that *A* or *B*, but not both are chosen?

A. $\frac{7}{12}$

B. $\frac{2}{3}$

C. $\frac{3}{4}$

D. $\frac{5}{6}$



57. A census is done of all the sport players in Year 10.

The Venn Diagram illustrates the results for three sports.

A sport player is chosen at random from Year 10.

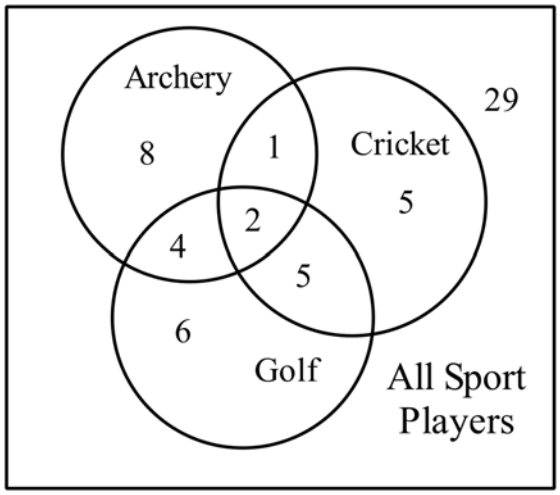
What is the probability that they play both Golf and Archery?

A. $\frac{1}{30}$

B. $\frac{1}{15}$

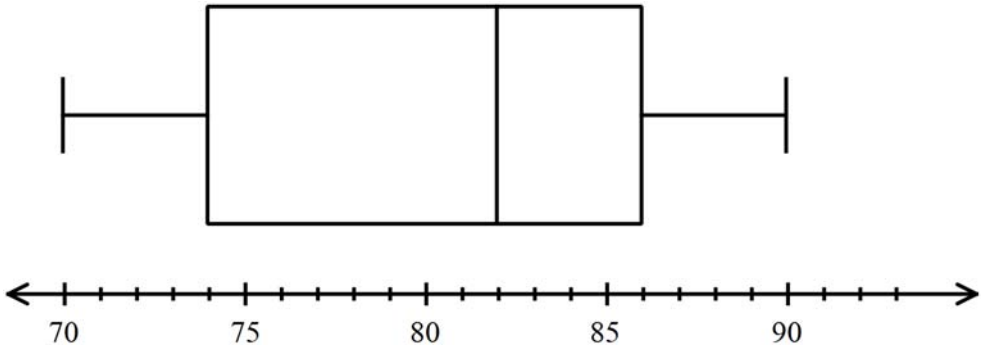
C. $\frac{1}{10}$

D. $\frac{13}{30}$



58. A group of 240 people had their arm length (in cm) recorded.

The results are summarised in the box-and-whisker plot below.



How many people had arm lengths between 74 cm and 82 cm?

A. 60 B. 90 C. 120 D. 180

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59. What is the standard deviation of the scores in the table?

Score	Frequency
12	3
13	6
14	4
15	8
16	3

A. 0.63

B. 1..00

C. 1.26

D. 14.08

---

60. Two weeks ago, the twenty members of a pistol club all took part in an event and recorded their scores on a spreadsheet.

The mean of the results was 88.2 with a standard deviation of 4.3.

A week later in the next event, every member improved their individual score by 2 points.

What was the mean and standard deviation for the second event?

A. Mean = 88.2 and Standard deviation = 6.3

B. Mean = 88.2 and Standard deviation = 4.3

C. Mean = 90.2 and Standard deviation = 6.3

D. Mean = 90.2 and Standard deviation = 4.3

End of Section 2

Part A

School Name
Half Yearly Examination

Advanced Mathematics Course 2016

Section 2
Part B
Longer Answer Section

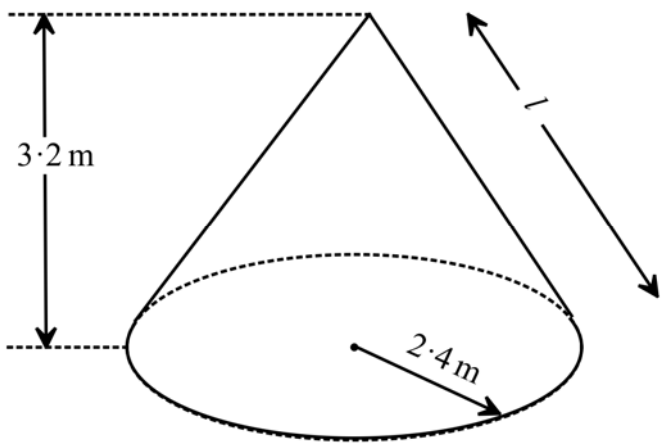
Name : _____

Class/Teacher_____

Write all working and answers in the spaces provided on this examination paper.
Calculators are allowed for this section.

Marks

61. A cone is shown which has a base radius of 2.4 m and a vertical height of 3.2 m.



(a) Calculate the slant height (l) of the cone. **1**

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(b) Calculate the surface area of the cone. **1**

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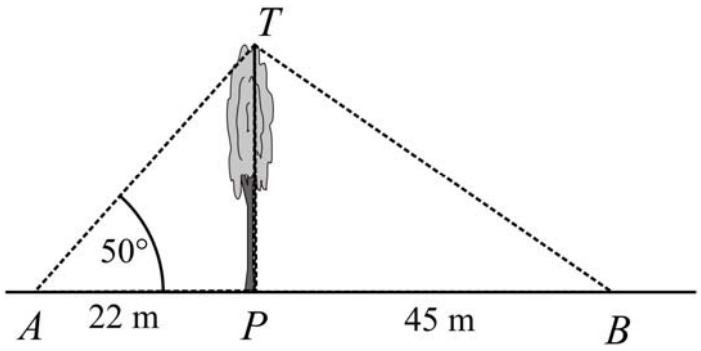
……

Marks

62. The tree *TP* stands on level ground between two points *A* and *B*.



From *A*, which is 22m from the base of the tree, the angle of elevation of the top of the tree is 50°.
Point *B* is 45m from the base of the tree,

(a) Calculate the height of the tree *TP*, correct to 3 significant figures **1**

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……

(b) Calculate the angle of elevation of the top of the tree from point *B*. **1**
Answer to the nearest degree

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……

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63. (a) Expand and simplify $2x(2x-3)(3x-2)$. **1**

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……

(b) Factorise $3x^2 - 5x + 2$. **1**

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……

(c) Hence simplify: $\dfrac{12x^3 - 26x^2 + 12x}{14x^2 - 21x} \times \dfrac{7x+7}{3x^2 - 5x + 2}$. **1**

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64. Show that the points $S(-3, -4)$, $T(-8, 8)$ and $U(5, 8)$ form an isosceles triangle on the number plane. **2**

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65. (a) Solve $2x^2 + 9x + 8 = 0$, giving your answer correct to 1 decimal place. **2**

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(b) Make a the subject of the equation $s = ut + \dfrac{1}{2}at^2$. **1**

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66. On the number plane below, draw a neat sketch of $y = x^2 + 4x + 6$, showing the axis of symmetry, the vertex and any intercepts on the axes. **3**

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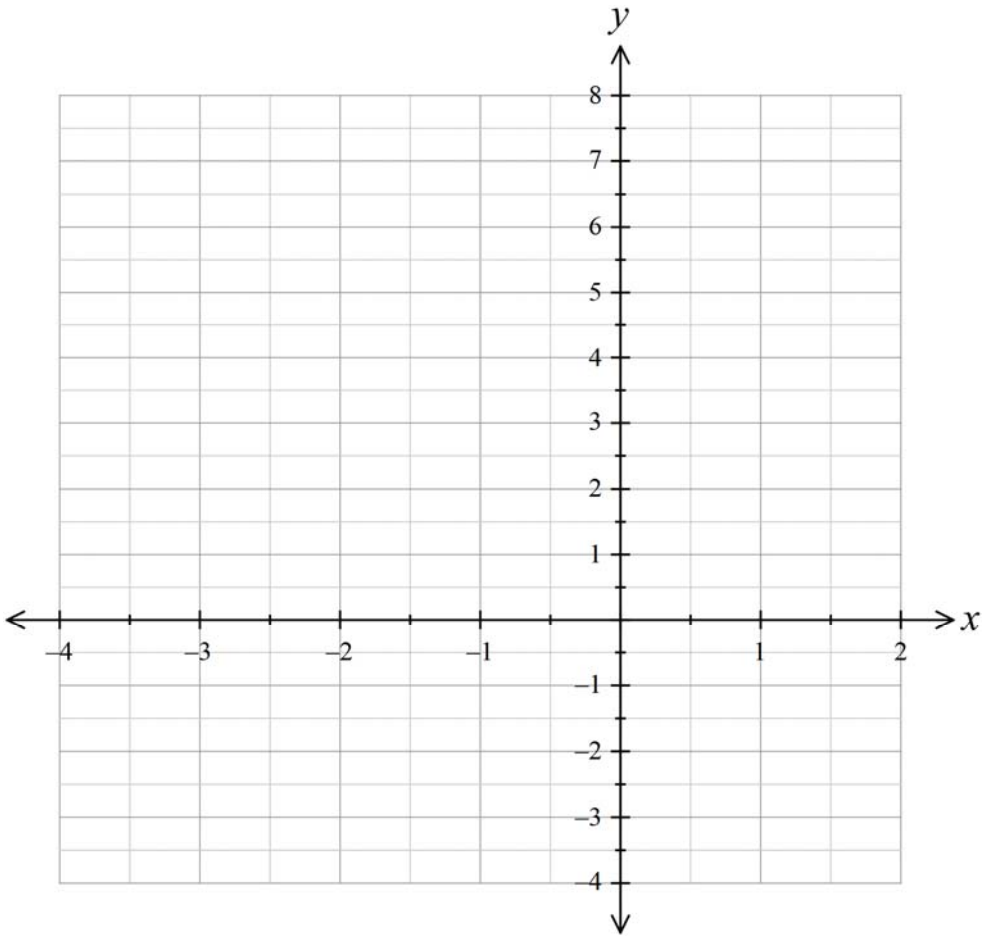

67. (a) Expand and simplify $\left(1-2\sqrt{3}\right)\left(5+2\sqrt{3}\right)$. **1**

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(b) Express $\dfrac{1-2\sqrt{7}}{5-\sqrt{7}}$ as a simplified surd fraction with a rational denominator. **2**

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68. The stem-and-leaf plot below shows the scores by quiz contestants.

0	8	9				
1	3	5	8	9	9	
2	2	4	5	5	7	7
3	1	3	5	8		
4	3	7				
5	2					
6	6					

(a) Find the standard deviation of the distribution. **1**

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(b) Describe the shape of the distribution in terms of symmetry or skewness. **1**

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End of Exam

School Name

Year 10 Half Yearly Examination

Advanced Mathematics Course 2016

Multiple Choice Section Answer Sheet

Name _____ Teacher _____

Completely fill the response oval representing the most correct answer.
Use a black or blue pen or 2B pencil.

21.	A ⬭	B ⬭	C ⬭	D ⬭		41.	A ⬭	B ⬭	C ⬭	D ⬭
22.	A ⬭	B ⬭	C ⬭	D ⬭		42.	A ⬭	B ⬭	C ⬭	D ⬭
23.	A ⬭	B ⬭	C ⬭	D ⬭		43.	A ⬭	B ⬭	C ⬭	D ⬭
24.	A ⬭	B ⬭	C ⬭	D ⬭		44.	A ⬭	B ⬭	C ⬭	D ⬭
25.	A ⬭	B ⬭	C ⬭	D ⬭		45.	A ⬭	B ⬭	C ⬭	D ⬭
26.	A ⬭	B ⬭	C ⬭	D ⬭		46.	A ⬭	B ⬭	C ⬭	D ⬭
27.	A ⬭	B ⬭	C ⬭	D ⬭		47.	A ⬭	B ⬭	C ⬭	D ⬭
28.	A ⬭	B ⬭	C ⬭	D ⬭		48.	A ⬭	B ⬭	C ⬭	D ⬭
29.	A ⬭	B ⬭	C ⬭	D ⬭		49.	A ⬭	B ⬭	C ⬭	D ⬭
30.	A ⬭	B ⬭	C ⬭	D ⬭		50.	A ⬭	B ⬭	C ⬭	D ⬭
31.	A ⬭	B ⬭	C ⬭	D ⬭		51.	A ⬭	B ⬭	C ⬭	D ⬭
32.	A ⬭	B ⬭	C ⬭	D ⬭		52.	A ⬭	B ⬭	C ⬭	D ⬭
33.	A ⬭	B ⬭	C ⬭	D ⬭		53.	A ⬭	B ⬭	C ⬭	D ⬭
34.	A ⬭	B ⬭	C ⬭	D ⬭		54.	A ⬭	B ⬭	C ⬭	D ⬭
35.	A ⬭	B ⬭	C ⬭	D ⬭		55.	A ⬭	B ⬭	C ⬭	D ⬭
36.	A ⬭	B ⬭	C ⬭	D ⬭		56.	A ⬭	B ⬭	C ⬭	D ⬭
37.	A ⬭	B ⬭	C ⬭	D ⬭		57.	A ⬭	B ⬭	C ⬭	D ⬭
38.	A ⬭	B ⬭	C ⬭	D ⬭		58.	A ⬭	B ⬭	C ⬭	D ⬭
39.	A ⬭	B ⬭	C ⬭	D ⬭		59.	A ⬭	B ⬭	C ⬭	D ⬭
40.	A ⬭	B ⬭	C ⬭	D ⬭		60.	A ⬭	B ⬭	C ⬭	D ⬭