THE ENGLISH COLLEGE IN PRAGUE

Mathematics Entrance Examination

Practice set B

Formula List

For the equation $ax^2 + bx + c = 0$ $\quad x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Curved surface area, A, of cylinder of radius r, height h. $\quad A = 2\pi rh$

Curved surface area, A, of cone of radius r, sloping edge l. $\quad A = \pi rl$

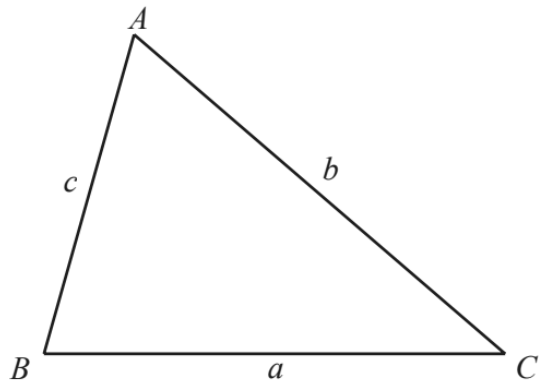
Curved surface area, A, of sphere of radius r. $\quad A = 4\pi r^2$

Volume, V, of pyramid, base area A, height h. $\quad V = \frac{1}{3}Ah$

Volume, V, of cylinder of radius r, height h. $\quad V = \pi r^2 h$

Volume, V, of cone of radius r, height h. $\quad V = \frac{1}{3}\pi r^2 h$

Volume, V, of sphere of radius r. $\quad V = \frac{4}{3}\pi r^3$



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

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

$$\text{Area} = \frac{1}{2}bc\sin A$$

Questions

Q1.

(a) Write down all the factors of 28

.....

(2)

(b) Which two of the following numbers are prime numbers?

2 9 14 15 18 23 30

..... and .....

(2)

(Total for question = 4 marks)

Q2.

(a) Helen's savings increased from £155 to £167.40

Work out the percentage increase in Helen's savings.

..... %

(3)

(b) Joe's savings increased by 4.5%.
His savings are now £125.40

What were his savings before the increase?

£ = ...

(3)

(Total for Question is 6 marks)

Q3.

In the 2012 Paralympic Games, the total number of gold and silver medals won by Brazil was 35
The ratio of the number of gold medals that Brazil won to the number of silver medals that Brazil won was 3 : 2

How many silver medals were won by Brazil?

.....

(Total for Question is 2 marks)

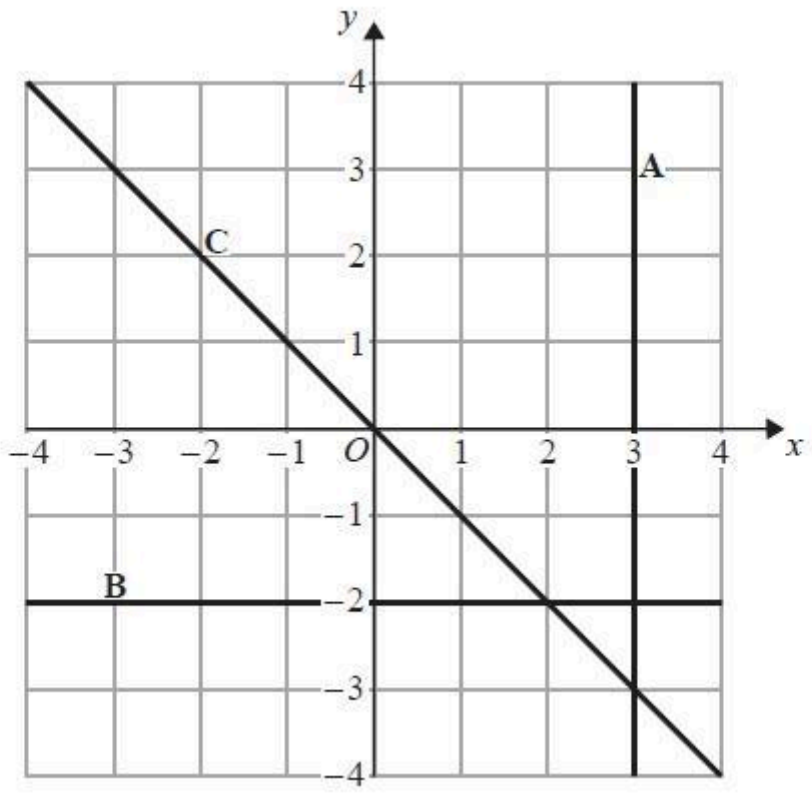
Q4.

Show that $(6 - \sqrt{8})^2 = 44 - 24\sqrt{2}$
Show each stage of your working clearly.

(Total for question = 3 marks)

Q5.

Here are three straight lines **A**, **B** and **C** drawn on a grid.



Write down an equation for each of these three straight lines.

A.....

B.....

C.....

(Total for question = 3 marks)

Q6.

$f = 5p - 4v$

Work out the value of p when $f = -22$ and $v = -5$

$p =$ .....

(Total for Question is 2 marks)

Q7.

Solve the simultaneous equations

$$5y - 4x = 8$$
$$y + x = 7$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for question = 3 marks)

Q8.

Solve $\frac{2}{5x-2} = \frac{3}{6x+1}$

Show clear algebraic working.

x = ...

(Total for question = 4 marks)

Q9.

Simplify fully $\frac{6x^2 + x - 15}{12x^2 - 27}$

Show clear algebraic working.

.....

(Total for question = 4 marks)

Q10.

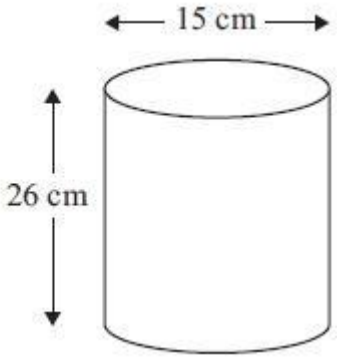


Diagram **NOT** accurately drawn

A cylinder has a diameter of 15 cm and a height of 26 cm.

Work out the volume of the cylinder.
Give your answer correct to 3 significant figures.

..... cm^3

(Total for question is 3 marks)

Q11.

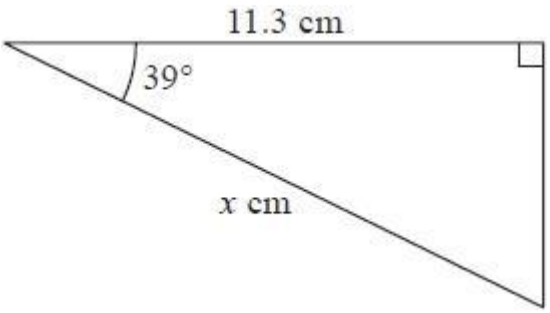


Diagram **NOT** accurately drawn

Work out the value of *x*.
Give your answer correct to 2 decimal places.

x = ...

(Total for question = 3 marks)

Q12.

The diagram shows a sector *OAPB* of a circle, centre *O*.

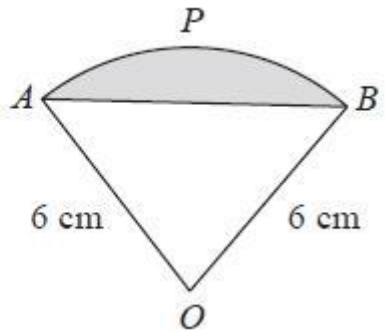


Diagram **NOT** accurately drawn

AB is a chord of the circle.
OA = *OB* = 6 cm.

The area of sector *OAPB* is 5π cm^2

Calculate the perimeter of the shaded segment.
Give your answer correct to 3 significant figures.

..... cm

(Total for question = 6 marks)

Q13.

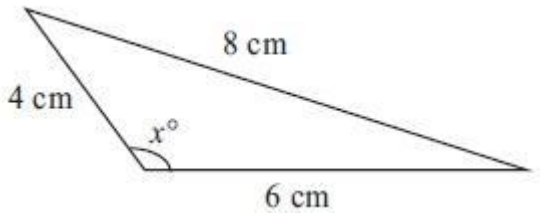


Diagram **NOT** accurately drawn

Calculate the value of *x*.
Give your answer correct to 1 decimal place.

x = ...

(Total for question is 3 marks)

Q14.

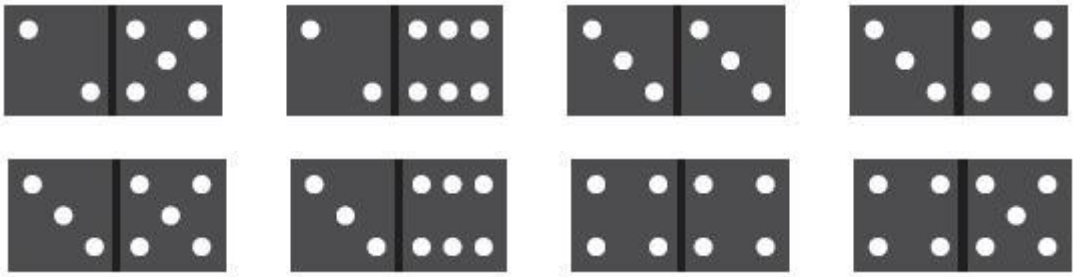
A group of students take a test.
The group consists of 12 boys and 8 girls.
The mean mark for the boys is 18
The mean mark for the girls is 16.5
Calculate the mean mark for the whole group.

.....

(Total for question = 4 marks)

Q15.

Here are 8 dominoes.



The 8 dominoes are put in a bag.
Helima takes at random a domino from the bag.

(a) Find the probability that she takes a domino with a total of

(i) more than 5 spots,

.....

(ii) 6 spots,

.....

(iii) 7 spots,

.....

(4)

Riaz takes at random a domino from the bag of 8 dominoes.

(b) Find the probability that he takes a domino with a total of 8 spots or a domino with a total of 9 spots.

.....

(2)

(Total for question is 6 marks)

Mark Scheme

Q1.

(c)		1,2,4,7,14,28	2	B2	B1 for at least 3 correct factors and none incorrect, may be seen as product pairs; ignore repeats; ignore negatives. Allow 1 mark if all correct and at most 1 incorrect.
(d)		2, 23	2	B2	B1 for 2 or 23; if more than 2 given, -1 for each incorrect value
					Total 7 marks

Q2.

Question	Working	Answer	Mark	Notes		
(a)	167.4 – 155 (= 12.4) "12.4" ÷ 155 (= 0.08)	8	3	M1 M1 dep A1 cao	167.4 ÷ 155 (= 1.08) "1.08" – 1 (= 0.08)	167.4 ÷ 155 (= 1.08) "1.08" × 100 (= 108) If build up approach used, award M2A1 for correct answer, otherwise M0A0.
(b)	$\frac{125.4}{104.5} \times 100$ oe	120	3	M2 M1 for $\frac{125.4}{104.5}$ (= 1.2) or 104.5% = 125.4 or $1.045x = 125.4$ oe or 1.2 seen or 5.4 A1 If build up approach used, award M2A1 for correct answer, otherwise M0A0.		
				Total 6 marks		

Q3.

Question	Working	Answer	Mark	Notes
	35÷ (3+2) **or** 35÷5 **or** $\frac{2}{5}\times 35$			M1 allow $\frac{3}{5}\times 35$ (=21)
	7 × 2	14	2	A1 NB 14 : 21 on answer line scores M1 A0 unless 14 identified
				Total 2 marks

Q4.

Question Number	Working	Answer	Mark	Notes
	36 – 6√8 – 6√8 + 8 or 36 – 12√8 + 8 44 – 12√(4 x 2) 44 – 12 √4 x √2	44 – 24√2*	3	M2 M1 for $6^2+(\sqrt{8})^2$ or 36 + 8 or $6^2+\sqrt{64}$ or –12√8 or –6√8 –6√8 M1 for (–)12√8 = (–)12 x 2√2 or √8 = 2√2 or 6√8 = 6 x2√2 Must see √8 stated as 2√2 for final M1
	LHS = $(6-2\sqrt{2})^2$ or √8 = 2√2 6^2 –12√2 – 12√2 + 4 x 2 or 36 – 24√2 + 8			Alt: M1 M2 M1 for 6^2+4 x 2 or 36 + 8
				Total 3 marks

Q5.

Ques	Working	Answer	Mark	Notes
		A $x = 3$ B $y = -2$ C $y = -x$	3	B1 B1 B1
				Total 3 marks

Q6.

Question	Working	Answer	Mark	Notes
	eg. $-22 = 5 \times p - 4 \times -5$ **or** $5p = -22 + 4 \times -5$			M1 for correct substitution (must be into a correct equation)
	eg. $-22 = 5p + 20$ **or** $5p = -22 - 20$ **or** $p = \frac{-22-20}{5}$			M1 for correct simplification (minimum of $-4 \times -5 = +20$)
		-8.4 oe	2	A1 (accept $-\frac{42}{5}$ or $-8\frac{2}{5}$ oe)
				Total 3 marks

Q7.

Q	Working	Answer	Mark	Notes
	Eg $9y = 36$ or $9x = 27$ or $5(7 - x) - 4x = 8$ or $5y - 4(7 - y) = 8$		3	M1 For a correct method to find an equation in x or y. Condone 1 arithmetic error.
		$x = 3$, $y = 4$		A2 Dep on M1 A1 for each value
				Total 3 marks

Q8.

Q	Working	Answer	Mark	Notes
	$2(6x+1) = 3(5x-2)$ or $\frac{2(6x+1)}{(5x-2)(6x+1)} = \frac{3(5x-2)}{(5x-2)(6x+1)}$		4	M1 Need to see both expressions in an equation May be implied by second M1; NB: Denominators must be correct
	$12x+2 = 15x-6$ or $\frac{12x+2}{(5x-2)(6x+1)} = \frac{15x-6}{(5x-2)(6x+1)}$			M1 Need to see both expressions in an equation NB: Denominators must be correct
	$3x = 8$ or $-3x = -8$ or $3x = 2+6$ or $-3x = -6-2$ or $15x-12x = 8$ or $12x-15x = -8$ or $3x-8 = 0$			M1 dep on awarding first two method marks for correct rearrangement with x terms on one side and numbers on the other AND correct collection of terms on at least one side or for $3x-8=0$
		$2\frac{2}{3}$ oe		A1 for $2\frac{2}{3}$ oe including decimal equivalent rounded or truncated to at least 2 decimal places Award 4 marks if first two method marks scored and answer correct.
				Total 4 marks

Q9.

The correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.

Question	Working	Answer	Mark	Notes
	$(2x \pm 3)(3x \pm 5)$		4	M1
	$3(2x-3)(2x+3)$ **or**			M2
	$(2x-3)(6x+9)$			(M1 for $3(4x^2-9)$ **or** $(6x-9)(2x+3)$)
		$\frac{3x+5}{3(2x+3)}$		A1 accept $\frac{3x+5}{6x+9}$
				Total 4 marks

Q10.

Question	Working	Answer	Mark	Notes
	$\pi \times 7.5^2 \times 26$	4590	3	M2 M1 for $\pi \times 15^2 \times 26$ or 18369 → 18386 inc A1 (4594.579....) accept answers 4592 → 4597 inc
				Total 3 marks

Q11.

The correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.

Question	Working	Answer	Marks	Comments
	$\cos 39 = \frac{11.3}{x}$ oe		3	M1 or $\frac{x}{\sin 90} = \frac{11.3}{\sin(180-90-39)}$
	$(x =) \frac{11.3}{\cos 39}$			M1 or $x = \frac{11.3}{\sin(180-90-39)} \times \sin 90$
		14.54		A1 awrt 14.54
	Alternative			
	$\tan 39 = \frac{y}{11.3}$; $y = 9.15...$ "9.15"$^2 + 11.3^2 = x^2$ oe			M1 Must get to correct Pythagoras statement
	$(x =) \sqrt{"9.15"^2 + 11.3^2}$ oe			M1
		14.54		A1 awrt 14.54 **(NB: 14.5 with no working gains M0A0)**
				Total 3 marks

Q12.

Q	Working	Answer	Mark	Notes	
	$\frac{x}{360}\times\pi\times r^2 = 5\pi$		6	M1 for this mark only condone an incorrect value for r	
	$x = 50$			A1 cao for angle $AOB = 50$	
	$(AB^2=)\ 6^2 + 6^2 - 2\times6\times6\times\cos("50")$			M1 dep on first M1 or $6\times\sin("50"/2)$	M2 for $(AB=)$ $\sqrt{25.7...}$ or 5.07....or $2\times 6\times\sin"50"/2$
	$(AB=)\ \sqrt{25.7...}$ or 5.07....			M1 dep or $2\times 6\times\sin("50"/2)$	
	$\frac{"50"}{360}\times2\times\pi\times6$ or $\frac{5\pi\times2\pi\times6}{\pi\times6^2}$ or $\frac{5}{3}\pi$ or 5.23...			M1 dep on first M1 if "50" used but indep if angle not used	
		10.3		A1 for answer in range 10.2 – 10.31	
					Total 6 marks

Q13.

Question	Working	Answer	Mark	Notes
	$(\cos x^\circ =)\frac{4^2+6^2-8^2}{2\times4\times6}$ or $8^2 = 4^2 + 6^2 - 2\times4\times6\cos x^\circ$		3	M1 for correct substitution in Cosine Rule
	$(\cos x^\circ =) -0.25$ oe			A1
		104.5		A1 for value rounding to 104.5 (104.4775...)
				Total 3 marks

Q14.

Question Number	Working	Answer	Mark	Notes
	(12 x 18) + (8 x 16.5) (=348) "348" ÷ 20	17.4	4	M2 M1 for 12 x 18 (=216) or 8 x 16.5 (=132) M1 dep on at least 1 previous M1 A1 17.4
				Alt Ratio method M1: 12:8 = 3:2 or 6:4 M1: 18 x3 and 16.5 x 2 or 18 x 6 and 16.5 x 4 M1: (18 x 3 + 16.5 x 2) ÷ 5 or (18 x 6 + 16.5 x 4) ÷ 10 A1: 17.4
				Alt Proportion method M1 60 % boys and 40% girls stated or implied M2 (0.6 x 18) + (0.4 x 16.5) (= 10.8 + 6.6) M1 for 0.6 x 18 or 0.4 x 16.5 A1 17.4
				SC B1 for 17.1 (from {(8 x 18) + (12 x 16.5)}÷20)
				Total 4 marks

Q15.

Question	Working	Answer	Mark	Notes		
(a)(i)		1	4	B1	Also accept $\frac{1}{1}$, $\frac{8}{8}$, 100%	
(ii)		$\frac{1}{8}$		B1		
(iii)		$\frac{2}{8}$ or $\frac{1}{4}$		M1 A1	for denominator of 8 for numerator of 2	SC B2 for $\frac{1}{4}$
(b)	$\frac{3}{8} + \frac{2}{8}$ oe		2	M1		
		$\frac{5}{8}$		A1		
						Total 6 marks