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4MA1 June 2027 Paper 1H Best Guess Paper

Higher · Standard · Model Answers

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Video walkthrough

Calculator allowed · 25 questions · 100 marks · Suggested time: 2 hours.

Paper 1H · Standard Higher · Model Answers

Question 1 · Mixed-number multiplication · 3 marks

Convert both mixed numbers: $3\frac{1}{5} = \frac{16}{5}$ and $2\frac{5}{8} = \frac{21}{8}$.

Multiply: $\frac{16}{5} \times \frac{21}{8} = \frac{336}{40} = \frac{42}{5}$.

Convert back: $\frac{42}{5} = 8\frac{2}{5}$. This proves the stated result.

Answer: $8\frac{2}{5}$, as required.

Question 2 · Prime factorisation · 2 marks

$124 = 2 \times 62 = 2 \times 2 \times 31$.

31 is prime, so the prime factorisation is $2^2 \times 31$.

Answer: $2^2 \times 31$

Question 3 · Algebra · 6 marks

Part (a)

Expand both brackets: $6x - 15 - 2x - 8$.

Collect terms: $(6x - 2x) - 15 - 8 = 4x - 23$.

Answer: $4x - 23$

Part (b)

The greatest common factor of $18a^2b$ and $12ab^2$ is $6ab$.

Divide each term by $6ab$ to obtain $6ab(3a - 2b)$.

Answer: $6ab(3a - 2b)$

Part (c)

$5y - 3 > 2y + 12$ gives $3y > 15$.

Divide by positive 3; the inequality stays in the same direction: $y > 5$.

Answer: $y > 5$

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Question 4 · Modal class and estimated mean · 4 marks

Part (a)

The highest frequency is 14, so the modal class interval is $20 < h \leq 30$.

Answer: $20 < h \leq 30$

Part (b)

Use class midpoints 15, 25, 35 and 45.

Sum of midpoint $\times$ frequency $= 15 \times 8 + 25 \times 14 + 35 \times 12 + 45 \times 6 = 1160$.

Estimated mean $= 1160 \div 40 = 29$ cm.

Answer: 29 cm

Question 5 · Sets and Venn diagrams · 4 marks

Part (a)

$A = \{2, 3, 5, 7, 11\}$ and $B = \{3, 6, 9, 12\}$; put 3 in the intersection.

Put 2, 5, 7, 11 in A only and 6, 9, 12 in B only.

Put 1, 4, 8, 10 outside both circles, inside the universal set. All 12 numbers must appear exactly once.

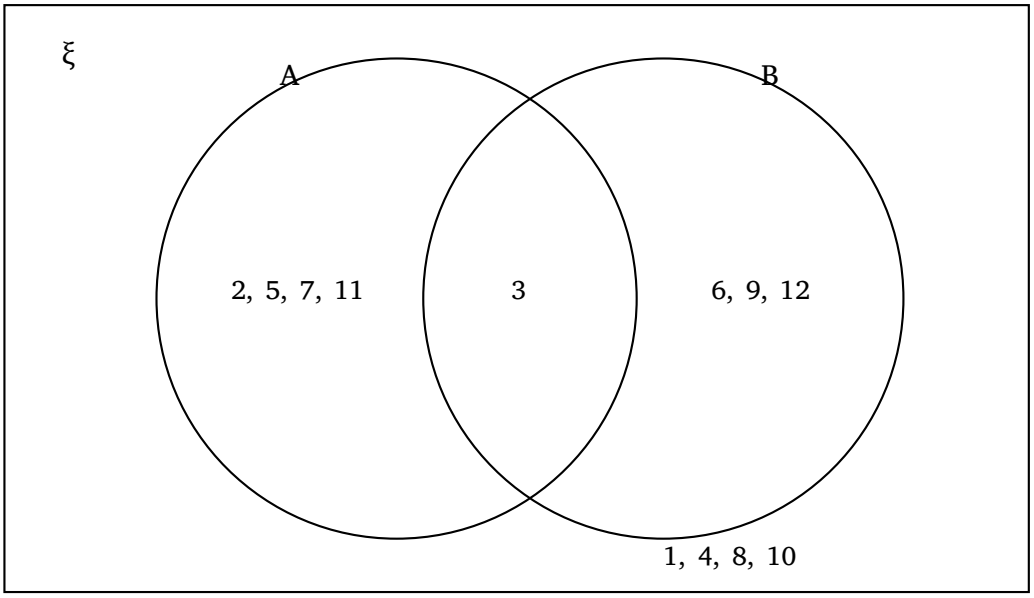
Answer: A only: 2, 5, 7, 11; intersection: 3; B only: 6, 9, 12; outside: 1, 4, 8, 10.

Part (b)

$A \cup B = \{2, 3, 5, 6, 7, 9, 11, 12\}$, so $P(A \cup B) = \frac{8}{12} = \frac{2}{3}$.

Answer: $\frac{2}{3}$

Diagram for Q5



Question 6 · Reverse compound depreciation · 3 marks

The annual multiplier is $1 - 0.12 = 0.88$.

If the original value is V, then $V \times 0.88^3 = 15{,}400$, so $V = 15{,}400 \div 0.88^3$.

$V = 22{,}598.14049\ldots$; to the nearest pound the value was £22,598.

Answer: £22,598

Question 7 · Cylinder surface area · 3 marks

Total surface area includes two circular ends and the curved surface: $2\pi r^2 + 2\pi rh$.

Substitute $r = 5.4$ and $h = 12$: $2\pi(5.4)^2 + 2\pi(5.4)(12) = 187.92\pi$.

$187.92\pi = 590.36809\ldots$ cm^2, which is 590 cm^2 to 3 significant figures.

Answer: 590 cm^2 (3 significant figures)

Question 8 · Ratio and mass · 4 marks

There are $7 + 5 = 12$ parts, so one part represents $180 \div 12 = 15$ bags.

Small bags: $7 \times 15 = 105$. Large bags: $5 \times 15 = 75$.

Total mass $= 105 \times 65 + 75 \times 145 = 6825 + 10875 = 17700$ grams.

$17700 \div 1000 = 17.7$ kg. This is more than 17 kg, so Zoe is not correct.

Answer: No; 17.7 kg of beads are needed.

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Question 9 · Linear simultaneous equations · 3 marks

Multiply the first equation by 3 and the second by 2: $9x + 6y = 42$ and $10x - 6y = 34$. Add to get $19x = 76$.

Therefore $x = 4$.

Substitute into $3x + 2y = 14$: $12 + 2y = 14$, so $y = 1$. Both original equations are satisfied.

Answer: $x = 4$, $y = 1$

Question 10 · Straight-line equation · 3 marks

Gradient $m = (17 - 5) \div (6 - 2) = 12 \div 4 = 3$.

Substitute $(2, 5)$ into $y = 3x + c$: $5 = 6 + c$, so $c = -1$.

The equation is $y = 3x - 1$; it also gives $y = 17$ when $x = 6$.

Answer: $y = 3x - 1$

Question 11 · Probability without replacement · 3 marks

Different colours can occur in two orders: red then blue, or blue then red.

$\text{P(RB)} = \frac{7}{12} \times \frac{5}{11}$ and $\text{P(BR)} = \frac{5}{12} \times \frac{7}{11}$.

Add the mutually exclusive probabilities: $\frac{35 + 35}{132} = \frac{35}{66}$.

Answer: $\frac{35}{66}$

Question 12 · Circle theorems · 4 marks

Part (a)

Angle ABC and the 130° central angle stand on the same minor arc AC.

The angle at the centre is twice the angle at the circumference, so $ABC = 130^\circ \div 2 = 65^\circ$.

Answer: 65°

Part (b)

ABCD is cyclic; opposite angles ABC and ADC sum to 180°.

$ADC = 180^\circ - 65^\circ = 115^\circ$. Alternatively, halve the reflex central angle 230°.

Answer: 115°

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Question 13 · Quadratic sequences · 5 marks

Part (a)

Substitute $n = 1$ and $n = 2$: $1 - 3 + 5 = 3$ and $4 - 6 + 5 = 3$.

For $n = 3$: $9 - 9 + 5 = 5$. The first three terms are 3, 3, 5.

Answer: 3, 3, 5

Part (b)

Set $n^2 - 3n + 5 = 113$, giving $n^2 - 3n - 108 = 0$.

Factorise: $(n - 12)(n + 9) = 0$, so $n = 12$ or $n = -9$.

A term position must be a positive integer, so $n = 12$ is valid. Check: $144 - 36 + 5 = 113$.

Answer: Yes; 113 is the 12th term.

Question 14 · Similar Triangles and Sightlines · 4 marks

Measure both heights above Katie's eye level: $2 - 1.6 = 0.4$ m and $400 - 1.6 = 398.4$ m.

Similar triangles give total distance to the mountain $\div 15 = 398.4 \div 0.4 = 996$.

The total distance from Katie is $996 \times 15 = 14{,}940$ m.

The question asks for the distance beyond the tree: $14{,}940 - 15 = 14{,}925$ m.

Answer: 14,925 m

Question 15 · Cosine rule and triangle area · 5 marks

Part (a)

Use the cosine rule: $QR^2 = 18^2 + 24^2 - 2(18)(24)\cos 52^\circ$.

$QR^2 = 368.068485\ldots$; take the positive square root.

$QR = 19.185111\ldots$ cm $= 19.2$ cm to 3 significant figures.

Answer: QR = 19.2 cm

Part (b)

$$\text{Area} = \frac{1}{2} \times 18 \times 24 \times \sin 52^\circ.$$

Area $= 170.210322\ldots$ cm^2 $= 170$ cm^2 to 3 significant figures.

Answer: 170 cm^2

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Question 16 · Algebraic fraction simplification · 3 marks

Factorise the numerator: $2x^2 + 5x - 12 = (2x - 3)(x + 4)$.

Factorise the denominator: $2x^2 + 7x - 4 = (2x - 1)(x + 4)$.

Cancel the common factor $x + 4$: $\frac{(2x - 3)(x + 4)}{(2x - 1)(x + 4)} = \frac{2x - 3}{2x - 1}$.

Answer: $\frac{2x - 3}{2x - 1}$, with $x \neq -4, 1/2$.

Question 17 · Histogram interpretation · 4 marks

The known class has width $120 - 100 = 20$, so its frequency density is $30 \div 20 = 1.5$.

The last bar is 8 fifteenths of the known bar's height, so its density is $1.5 \times \frac{8}{15} = 0.8$.

The last class has width $150 - 120 = 30$.

Frequency = density × class width $= 0.8 \times 30 = 24$ apples.

Answer: 24 apples

Question 18 · Direct proportion · 3 marks

Direct proportionality gives $y = kx^3$.

Use $x = 2$, $y = 40$: $40 = 8k$, so $k = 5$.

When $y = 1080$, $1080 = 5x^3$, giving $x^3 = 216$. Take the real cube root: $x = 6$.

Answer: $x = 6$

Question 19 · Algebraic fraction subtraction · 3 marks

Use common denominator $(x + 2)(x - 5)$.

Combine the numerators: $3(x - 5) - (x + 2) = 3x - 15 - x - 2 = 2x - 17$.

The result is $\frac{2x - 17}{(x + 2)(x - 5)}$. No common factor cancels. Original exclusions $x \neq -2, 5$ are not extra marks.

Answer: $\frac{2x - 17}{(x + 2)(x - 5)}$, with $x \neq -2, 5$.

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Question 20 · Functions and inverses · 7 marks

Part (a)

$f(4) = \dfrac{2 \times 4 + 1}{4 - 3} = 9.$

Answer: 9

Part (b)

Compose the functions: $fg(x) = \dfrac{2(x^2 - 4) + 1}{(x^2 - 4) - 3} = \dfrac{2x^2 - 7}{x^2 - 7}.$

Set $\dfrac{2x^2 - 7}{x^2 - 7} = \dfrac{11}{2}$ and cross-multiply: $2(2x^2 - 7) = 11(x^2 - 7)$.

Expand: $4x^2 - 14 = 11x^2 - 77$, so $7x^2 = 63$ and $x^2 = 9$.

Therefore $x = 3$ or $x = -3$. Both are valid because $x^2 - 7 = 2$, not zero.

Answer: $x = 3$ or $x = -3$

Part (c)

Write $y = \dfrac{2x + 1}{x - 3}$. Then $xy - 3y = 2x + 1$, so $x(y - 2) = 3y + 1$.

Interchange the variables: $f^{-1}(x) = \dfrac{3x + 1}{x - 2}$, with $x \neq 2$.

Answer: $f^{-1}(x) = \dfrac{3x + 1}{x - 2}$, $x \neq 2$.

Question 21 · Vectors in a parallelogram · 4 marks

$AC = OC - OA = c - a.$

$AX : XC = 1 : 3$ means $AX = \dfrac{1}{4}AC = \dfrac{1}{4}(c - a).$

$OX = OA + AX = a + \dfrac{1}{4}(c - a).$

Collect the vectors: $OX = \dfrac{3}{4}a + \dfrac{1}{4}c.$

Answer: $\dfrac{3}{4}a + \dfrac{1}{4}c$

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Question 22 · Overlapping Squares and Rectangles · 5 marks

Let the horizontal projection of PS be d. Since PS $= 5$ and the vertical separation is 4, $d^2 + 4^2 = 5^2$, so $d = 3$ cm.

Perpendicular square sides have interchanged horizontal and vertical projections: PQ rises 3 cm above AB. Also $PB = 4 + 3 = 7$ cm and $RB = 4 - 3 = 1$ cm.

Similar triangles give $BT \div RB = 3 \div 4$, so $BT = \frac{3}{4}$ cm and $PT = 7 - \frac{3}{4} = \frac{25}{4}$ cm.

The part of the square outside the rectangle is triangle PQT: area $= \frac{1}{2} \times \frac{25}{4} \times 3 = \frac{75}{8}$ cm^2.

Shaded overlap = square area − triangle area $= 25 - \frac{75}{8} = \frac{125}{8}$ cm^2 $= 15.625$ cm^2.

Answer: $\frac{125}{8}$ cm^2

Question 23 · Equation of a tangent to a circle · 4 marks

The radius from (3, 2) to A(7, 5) has gradient $\frac{5-2}{7-3} = \frac{3}{4}$.

The tangent is perpendicular to the radius, so its gradient is $-\frac{4}{3}$.

Using A(7, 5), its equation is $y - 5 = -\frac{4}{3}(x - 7)$.

Multiply by 3 and rearrange: $3y - 15 = -4x + 28$, so $4x + 3y = 43$.

Answer: $4x + 3y = 43$

Question 24 · Advanced Indices and Prime Bases · 5 marks

Use $10^{2n} = 2^{2n} \times 5^{2n}$ and $50^2 = 2^2 \times 5^4$.

Inside the bracket, combine powers and cancel 5^4: the expression becomes 2 raised to $(2n^2 - 6n - 2)$.

Raise to power $\frac{2}{3}$ and write $16 = 2^4$: $\frac{2}{3}(2n^2 - 6n - 2) = 4$.

Rearrange: $2n^2 - 6n - 2 = 6$, so $n^2 - 3n - 4 = 0 = (n - 4)(n + 1)$.

Both real solutions are valid: $n = 4$ or $n = -1$.

Answer: $n = 4$ or $n = -1$

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Question 25 · Cone and exact values · 6 marks

Total surface area is $\pi r^2 + \pi rl = 24\pi$.

Use $l = 3r$: $\pi r^2 + 3\pi r^2 = 24\pi$.

Hence $4r^2 = 24$, so $r^2 = 6$.

Pythagoras in the axial right triangle gives $h^2 = l^2 - r^2$.

Therefore $h^2 = 9r^2 - r^2 = 8r^2 = 48$.

As h is a length, $h = \sqrt{48} = 4\sqrt{3}$ cm.

Answer: $h = 4\sqrt{3}$ cm