All Boards Higher Mathematics Exam Practice Book
Answers to practice papers

Practice paper (non-calculator)

1 **a** 267 000 **b** 2.4×10^{-8} **c** 5×10^{4}

2 $8x^{15}y^{6}$

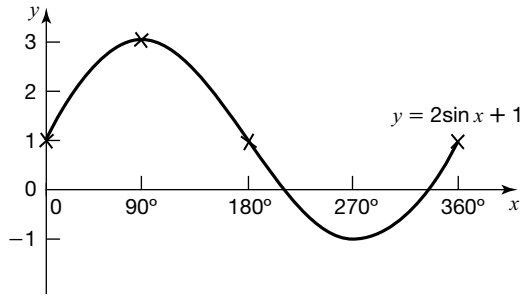
3 $6x^3 - 29x^2 + 14x + 24$

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

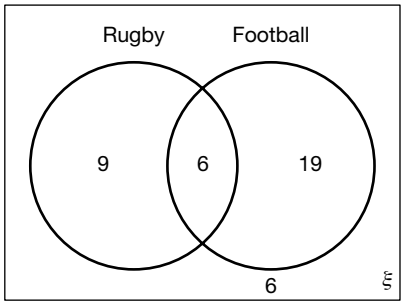
5 Try $x = 2$: $x^3 = 8 > x$, so statement is true for this value.
Try $x = -1$: $x^3 = -1 = x$, so statement is false.
Try $x = \frac{1}{2}$: $x^3 = \frac{1}{8} < x$, so statement is false.
John is incorrect.

6 $\frac{21 - 11\sqrt{3}}{6}$

7

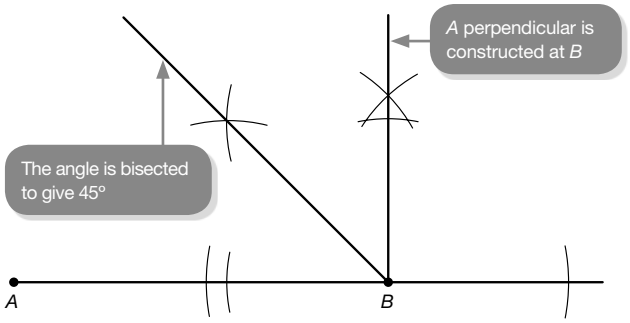


8 **a**



b P(rugby-playing boy picked at random also plays football) $= \frac{2}{5}$

9



10 **a** $a = 7$ and $b = 4$ **b** $\frac{1}{4}$ **c** $\frac{1}{8}$

11 $3x + 4y - 25 = 0$

12 **a** P(not 6, not 6, 6) $= \frac{9}{64}$

b P(at least one 6) = 1 − P(no 6s)
P(no 6s) $= \frac{3}{4} \times \frac{3}{4} \times \frac{3}{4} = \frac{27}{64}$
P(at least one 6) $= 1 - \frac{27}{64} = \frac{37}{64}$
$\frac{37}{64} > \frac{1}{2}$, so Amy is right.

13 **a** $n > 3$ **b** 4

14 $\overrightarrow{XY} = \overrightarrow{XO} + \overrightarrow{OY}$
$= -\mathbf{b} + 2\mathbf{a}$
$= 2\mathbf{a} - \mathbf{b}$
$\overrightarrow{XQ} = \frac{1}{2}\overrightarrow{XY} = \frac{1}{2}(2\mathbf{a} - \mathbf{b}) = \mathbf{a} - \frac{\mathbf{b}}{2}$
$\overrightarrow{PQ} = \overrightarrow{PO} + \overrightarrow{OX} + \overrightarrow{XQ}$
$= -\mathbf{a} + \mathbf{b} + \mathbf{a} - \frac{\mathbf{b}}{2}$
$= \frac{\mathbf{b}}{2}$
$\overrightarrow{OX} = \mathbf{b}$, so $\overrightarrow{PQ}$ and $\overrightarrow{OX}$ have the same vector part and are therefore parallel.

15 $\frac{7x - 3}{x(x-1)}$

16 **a** $f(-2) = 24$

b $f^{-1}(x) = \pm\sqrt{\frac{x-4}{5}}$

c $fg(x) = 5(x+1)^2 + 4$

17 **a** 5×7^2

b 35

18 $\frac{9}{4}$

19 P(blue) $= \frac{24}{45} = \frac{8}{15}$

20 328

21 **a** angle $STQ = 100°$

b angle $TSQ = 35°$ (angle in the alternate segment)

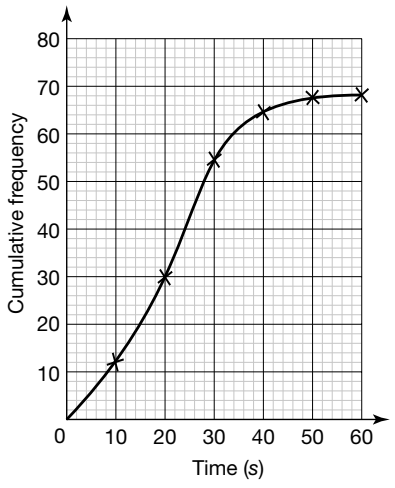
c angle $QRS = 80°$ (opposite angles of a cyclic quadrilateral add up to 180°)

d angle RQS = 180 − (60 + 80) = 40° (angles in a triangle add up to 180°)

22 **a**

Time for call to be answered (t seconds)	Frequency	Cumulative frequency
$0 < t \leq 10$	12	12
$10 < t \leq 20$	18	30
$20 < t \leq 30$	25	55
$30 < t \leq 40$	10	65
$40 < t \leq 50$	2	67
$50 < t \leq 60$	1	68

b



c 21 s

d 75% of 68 = 0.75 × 68 = 51

Reading off from 51 on the cumulative frequency axis gives a time of 28 s.

75% of calls are answered within 28 s, so the target is being met.

23 cost of adult ticket = £25

cost of child ticket = £18

24 **a** 27 **b** $\sqrt{3}^{n+1}$ **c** 9

25 **a** **i** 34 849 **ii** 34 750

b $3.46 < l < 3.47$ (The number cannot be as low as 3.46 as it originally had more decimal places.)*

26 $\tan 30° + \tan 60° + \cos 30° = \frac{1}{\sqrt{3}} + \sqrt{3} + \frac{\sqrt{3}}{2}$

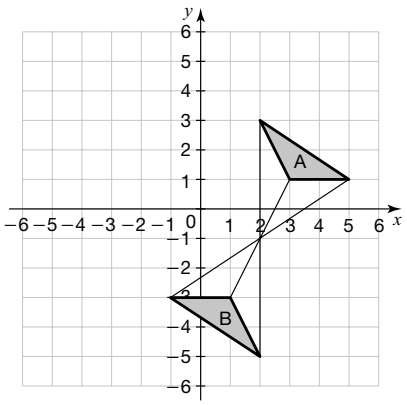
$= \frac{\sqrt{3}}{\sqrt{3}\sqrt{3}} + \sqrt{3} + \frac{\sqrt{3}}{2}$

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

$= \frac{2\sqrt{3} + 6\sqrt{3} + 3\sqrt{3}}{6}$

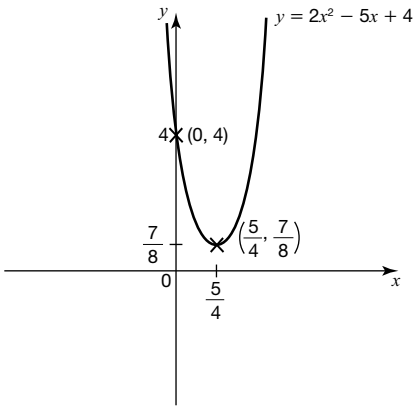
$= \frac{11\sqrt{3}}{6}$

27 **a**



b A rotation of 180° (clockwise or anticlockwise) about the point (2, −1).

28



Practice paper (calculator)

1 $3(2x + 5)(2x - 5)$

2 **a** $\frac{x-5}{2x+3}$

b $(x + 3)^2 + 3$

$a = 3$ and $b = 3$

3 $u = \frac{fv}{v - f}$

4 Say the cube has side 10 cm originally.

volume of original cube = 10 × 10 × 10 = 1000 cm³

Increasing the sides by 10% will make each side 11 cm.

volume of enlarged cube = 11 × 11 × 11 = 1331 cm³

increase in volume = 331 cm³

% increase in volume = $\frac{331}{1000} \times 100 = 33.1\%$

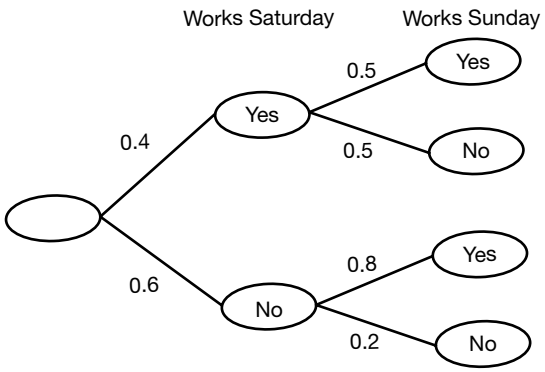
So Seema is wrong.

5 $18\sqrt{3}$ cm²

6 **a** **i** P(works Sunday, given works Saturday) = $\frac{0.2}{0.4} = 0.5$

ii P(does not work Sunday, given does not work Saturday) = 0.2

b



c P(only works one day over weekend) = 0.2 + 0.48 = 0.68

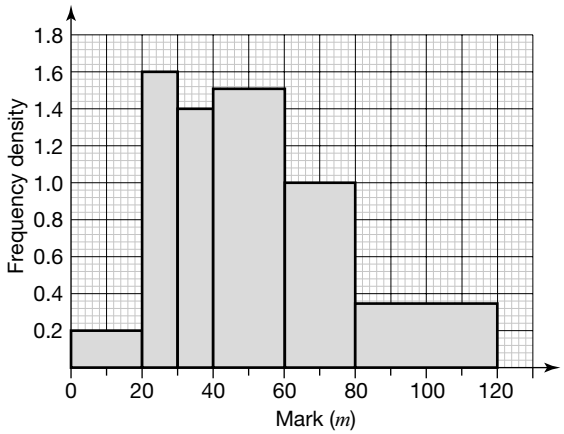
7 **a** $x > 3$ or $x < -4$

b $a = -4$ and $b = 1$

8 **a** $\frac{3}{22}$

b $0.\dot{3}$

9



*In the first edition of the Exam Practice book, the first sign on the answer line should have been <, not ≤. This has now been re-checked and corrected.

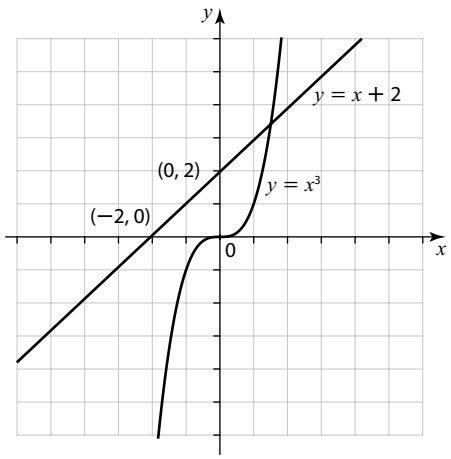
10 $\sin ACB = \frac{2 + 6\sqrt{2}}{17}$

$m = 6$ and $n = 17$

11 **a** $XY = 9\,\text{cm}$ **b** 4 : 1

$WZ = 4.5\,\text{cm}$

12 **a**



b 1

c 1.521 (to 3 d.p.)

13 **a** The 25% is applied to the sale price and not to the original price.

b 40%

14 £15 689.88 (to nearest penny)

15 3

16 £53.13 (to nearest penny)

17 **a** $26.6\,\text{m}^3$ (to 3 s.f.) **b** 23 weeks

18 **a** $y = \frac{0.625}{x^2}$

b $y = \frac{0.625}{x^2}$

When $x = 0.1$, $y = \frac{0.625}{0.1^2} = 62.5$

19 **a** $2x^3 + 3x^2 - 5x - 6$

b $x = \frac{2}{3}$

c $x < 1$

20 $8^2 + 15^2 = 64 + 225 = 289$

$17^2 = 289$

Pythagoras' theorem is obeyed, so the triangle is right-angled.

21 2.76 cm

22 **a** **i** $1.6\,\text{m/s}^2$

ii $0\,\text{m/s}^2$

b 360 m

c $55.5 \leq v < 56.5$

23 $41.6\,\text{cm}^2$ (3 s.f.)