Trigonometry – Paper 2 - Mark Scheme

Question 1

2	0	2	**M1** $4\sin^3 120$ evaluated and rounding to 2.6 or better (2.598…) or $\frac{3\sqrt{3}}{2}$

Question 2

3	cos38 sin38 sin158 cos158	**2**	**M1** correct decimals seen 0.7(88..) 0.6(15..) 0.3(74..) –0.9(271..)

Question 2*

25	63.4 or 63.43... 243.4 or 243.4...	**2**	**B1** for each If 0 scored **SC1** for two answers with a difference of 180

Question 3

11	**(a)** 10(.0..)	1	
	(b) 9.80	3	**M2** $\sqrt{((\mathbf{a})^2 - 2^2)}$ or **M1** $PT^2 + 2^2 = (\mathbf{a})^2$

Question 4

12	**(a)** 440	2	**M1** $\sin 37.1$ or $\cos 52.9 = \frac{h}{730}$ oe
	(b) 3 min 20 sec	2	**M1** $\frac{730}{3.65}$

Question 5

11	16.8	3	**M2** $\tan 17 = \frac{h}{55}$ or $\tan 73 = \frac{55}{h}$ **or M1** $\tan 17 = \frac{55}{h}$ or $\tan 73 = \frac{h}{55}$ if angle seen in wrong place at P

Question 6

5	23.6	2	**M1** $\sin R = 20/50$ or $\frac{20}{\sin R} = \frac{50}{\sin 90}$

Question 7

1	53.1	**2**	**B1** C = 36.9 seen, must have C stated or marked on the diagram or **M1** $\sin A = \frac{4}{5}$ or $\tan A = \frac{4}{3}$ but must have A stated

Question 8

5	23.2	**2**	**M1** for $\sin 53.2 = \frac{x}{29}$ implicit form or better

Question 9

9	452	**3**	**M1** $\tan 78.3 = \frac{x}{58.4}$ **M1** "282" + 170	**SC2** 282 in **answer space**

Question 10

21	**(a)** 73.7 or 73.73 to 73.74	**3**	**M1** for $\frac{20}{3+2}\times 2$ or **B1** for $BX = 8$ **M1** for tan [ ] = $\frac{6}{their\ 8}$ or better
	(b) **120**	**2**	**M1** for $\frac{1}{2}\times 20\times 12$ oe

Question 11

10	160	**3**	**M1** for sin 15 = $\frac{[]}{628}$ oe or better

Question 12

11	113.9 to 114.0	**4**	**M2** for [cos =] $\frac{8^2+2^2-9^2}{2\times 8\times 2}$ or **M1** for $9^2 = 8^2 + 2^2 - 2\times 8\times 2\times \cos x$ **A1** for –0.406 or –0.4063 to –0.4062 or $-\frac{13}{32}$ If **0** scored **SC2** for 54.3[1…] or 11.7 or 11.71 to 11.72 **SC1** for [cos =] $\frac{9^2+2^2-8^2}{2\times 9\times 2}$ or [cos =] $\frac{9^2+8^2-2^2}{2\times 9\times 8}$

Question 13

4		7.06 or 7.063 to 7.064	**2**	**M1** for $\frac{[\ ]}{8} = \cos 28$ or better

Question 14

3	66.4[2…]	**2**	**M1** for cos […=] $\frac{2}{5}$ oe

Question 15

11	6.24 or 6.244 to 6.245	**3**	**M2** for $\sqrt{8^2-5^2}$ or **M1** for $8^2 = 5^2 + x^2$ or better

Question 16

9	23.6 or 23.57 to 23.58	**2**	**M1** for sin[=] $\frac{2}{5}$ oe

Question 17

18	14.4 or 14.36...	**4**	**M3** for tan = $\frac{6}{their\sqrt{15^2+18^2}}$ oe or better or **M1** for $AC = \sqrt{15^2+18^2}$ and **M1** for identifying required angle

Question 18

3	75.1 or 75.09 to 75.10	**2**	**M1** for cos […=] $\frac{0.9}{3.5}$

Question 19

9	234 or 234.3 to 234.4	**3**	**M2** for [dist =] $\frac{300}{\tan 52}$ oe or **M1** for correct implicit trig statement allow **M1** if they use *their* 52 or *their* 38 provided it is marked on the diagram or **B1** for 52 or 38 correctly placed If zero scored, **SC1** for final answer 384

Question 20

6	31.7	**2**	**M1** 0.5 × 9 × 15 × sin 28

Question 21

18	122.2	**4**	**M2** for 13sin23/6 **A1** 57.8 or **M1** for $\frac{\sin 23}{6} = \frac{\sin A}{13}$

Question 22

21	**(a)** 37.2 or 37.17 to 37.19	**3**	**M2** for sin[ ] = $\frac{4\times\sin 65}{6}$ or **M1** for $\frac{4}{\sin[]} = \frac{6}{\sin 65}$ oe
	(b) 11.7 or 11.72 to 11.74	**3**	**M1** for [*B* =] 160 – 65 – *their* **(a)** **M1** for $\frac{1}{2}$ × 4 × 6 × sin *their* 77.8

Question 23

14		8.23 or 8.234 to 8.235	**3**	**M2** for [*PR*=] $\frac{12.5\times\sin 37}{\sin 66}$ or **M1** for $\frac{PR}{\sin 37} = \frac{12.5}{\sin 66}$ oe

Question 24

13	13.5 or 13.45[..]	**3**	**M2** for $\sqrt{\frac{2\times 85}{\sin 110}}$ or **M1** for ½ × a^2 × sin 110 = 85 or $\frac{2\times 85}{\sin 110}$ oe [180.9..]

Question 25

11	12.2 or 12.18 to 12.19	**3**	**M2** for $\frac{24\sin 30}{\sin 100}$ or **M1** for correct implicit equation e.g. $\frac{\sin 100}{24} = \frac{\sin 30}{BC}$

Question 26

20	9.37 or 9.370 to 9.371	**6**	**M2** for $\sin[P] = \frac{38.5}{0.5\times 9\times 10}$ or **M1** for $0.5 \times 10 \times 9 \times \sin = 38.5$ **M3** for $\sqrt{(9^2 + 10^2 - 2\times 9\times 10 \times \cos(\textit{their } P))}$ or **M2** for $9^2 + 10^2 - 2\times 9\times 10 \times \cos(\textit{their } P)$ or **M1** for a correct implicit expression e.g. $\cos(\textit{their } P) = \frac{9^2 + 10^2 - RQ^2}{2\times 9\times 10}$ Note: 87.8, 87.81[…] or 87.7[55…] score 4 marks or M is foot of perpendicular from R to PQ **M2** for perp.ht $= 38.5 \div \frac{1}{2} \times 10$ or 7.7 or **M1** for $\frac{1}{2} \times 10 \times [\ldots] = 38.5$ **M1** for $PM = \sqrt{(9^2 - 7.7^2)}$[= 4.659… or 4.66] **M1** for $QM = 10 - \textit{their}$ 4.659…[= 5.34…] **M1** for $QR = \sqrt{((\textit{their } QM)^2 + 7.7^2)}$

Question 27

13	8.12 or 8.118…	**3**	**M2** for $\frac{12.4}{\sin 74}\times \sin 39$ or **M1** for implicit version $\frac{\sin 39}{y} = \frac{\sin 74}{12.4}$ oe

Question 28

7	130 or 130.0 to 130.1	**2**	**M1** for ½ × 22.3 × 27.6 × sin25

Question 29

15	111.2 or 111.1 to 111.2	**4**	**M2** for [cos =] $\frac{2.8^2 + 3.6^2 - 5.3^2}{2\times 2.8\times 3.6}$ or **M1** for implicit form **A1** for [cos =] –0.362 to –0.361

Question 30

26 **(a)**	20.1 or 20.07 to 20.08	**2**	**M1** for $\frac{1}{2}\times 7\times 10\times \sin 35$ oe
(b)	5.86 or 5.858…..	**4**	**M2** for $7^2 + 10^2 - 2\times 7\times 10\times \cos 35$ **A1** for 34.3 .. or **M1** for $\cos 35 = \frac{7^2 + 10^2 - AC^2}{2\times 7\times 10}$

Question 31

21 (a)	14.4 or 14.42 to 14.43	**2**	**M1** for $\frac{1}{2} \times 6.2 \times 4.7 \times \sin 82$ oe
(b)	30.7 or 30.72…	**2**	**M1** for $\sin = \frac{2050}{\frac{1}{2} \times 107 \times 75}$

Question 32

14	19.3 or 19.26 to 19.27 nfww	**3**	**M2** for $[\sin =]5.9 \times \frac{\sin 84.6}{17.8}$ or **M1** for $\frac{5.9}{\sin B} = \frac{17.8}{\sin 84.6}$ oe

Question 33

19	46.2 or 46.17 to 46.18	**4**	**M2** for $[\cos =]\frac{16^2 + 19^2 - 14^2}{2 \times 16 \times 19}$ or **M1** for $14^2 = 19^2 + 16^2 - 2 \times 19 \times 16 \cos M$ **A1** for 0.692… or $\frac{421}{608}$

Question 34

19(a)	61.1 or 61.08 to 61.09...	**3**	**M2** for $[\sin x =] \frac{8 \sin 100}{9}$ oe or better or **M1** for $\frac{9}{\sin 100} = \frac{8}{\sin x}$ oe
19(b)	11.7 or 11.66 to 11.67	**3**	**M2** for $\frac{1}{2} \times 9 \times 8 \times \sin(180 - 100 - \textit{their}$ **(a)**$)$ oe or **M1** for $180 - 100 -$ *their* **(a)**

Question 35

21 (a)	7.55 www	**3**	**M2** $(\frac{1}{2}\sqrt{(8^2 + 8^2)})^2 + 5^2$ or $4^2 + 5^2 + 4^2$ seen **or M1** $8^2 + 8^2$ or $5^2 + 4^2$ or $4^2 + 4^2$ or $5^2 +$ (their MB)^2 seen
(b)	41.5 www	**3**	**M2** $\sin(B) = \frac{5}{\text{(a)}}$ or $\tan(B) = \frac{5}{\text{their } MB}$ or $\cos(B) = \frac{\text{their } MB}{\text{(a)}}$ or **M1** recognition of angle PBM

Question 36

24	**(a)** 12.7	**3**	**M2** for $10^2 + 5^2 + 6^2$ or **M1** for one of $10^2 + 5^2$ or $6^2 + 5^2$ or $10^2 + 6^2$
	(b) 28.2	**3**	**M2** for $\sin x = 6/$**(a)** or **M1** for identifying angle *PDB*

Question 37

23	24.8 or 24.77 to 24.78	**4**	**M1** for recognition of angle *CEA* **M1** for $\sqrt{12^2+5^2}$ **M1** for tan = $\frac{6}{\text{their } AE}$ oe

Question 38

21	**(a)**	4.47 or 4.472[…]	**3**	**M2** for $\sqrt{6^2-4^2}$ or **M1** for $[PM]^2+4^2=6^2$ or 6^2-4^2
	(b)	48.2 or 48.18 to 48.19	**3**	**M2** for cos[correct angle] $=\frac{4}{6}$ oe or **M1** for recognising a correct angle

Question 39

16		65.4 or 65.37 to 65.4	**4**	**M3** for cos $=\frac{5}{12}$ or $\frac{\sqrt{3^2+4^2}}{12}$ oe or **M1** for $\sqrt{3^2+4^2}$ and **M1** for clearly identifying angle *GAC*

Question 40

23	**(a)**	9.11 or 9.110…	**4**	**M3** for $\sqrt{5^2+3^2+7^2}$ or **M2** for $\sqrt{5^2+3^2}$ or $\sqrt{3^2+7^2}$ or $\sqrt{5^2+7^2}$ or **M1** for $5^2 + 3^2$ or $3^2 + 7^2$ or $5^2 + 7^2$
	(b)	33.3 or 33.28 to 33.29	**3**	**M2** for sin = $\frac{5}{their(a)}$ oe or **B1** for identifying angle *ECH*

Question 41

24	**(a)**	13.9 or 13.85 to 13.86	**3**	**M2** for $\sqrt{8^2+8^2+8^2}$ oe or **M1** for 8^2+8^2 or better for one face
	(b)	35.1 to 35.5[4…]	**2**	**M1** for sin = $\frac{8}{their\,(a)}$ or cos = $\frac{\sqrt{8^2+8^2}}{their\,(a)}$ or tan = $\frac{8}{\sqrt{8^2+8^2}}$ oe